PROCEEDINGS OF THE

SECOND ANNUAL REUNION

OF THE OHIO STATE BOARD OF AGRICULTURE,
THE COLLEGE OF AGRICULTURE, OHIO STATE UNIVERSITY,
THE FARMERS' INSTITUTE LECTURERS OF OHIO,
AND THE OHIO AGRICULTURAL EXPERIMENT STATION

OHIO
Agricultural Experiment Station.

WOOSTER, OHIO, U. S. A., JUNE, 1904.

BULLETIN 151.

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EXPERIMENT STATION, Wooster, Ohio.

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OHIO AGRICULTURAL EXPERIMENT STATION.

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BULLETIN

OF THE

Ohio Agricultural Experiment Station

No 151 JUNE, 1904.

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SECOND ANNUAL REUNION

OF THE

THE OHIO STATE BOARD OF AGRICULTURE,
THE COLLEGE OF AGRICULTURE, OHIO STATE UNIVERSITY,
THE FARMERS' INSTITUTE LECTURERS OF OHIO,
AND THE OHIO AGRICULTURAL EXPERIMENT STATION,

HELD IN THE MUSEUM ON THE GROUNDS

OF THE

OHIO AGRICULTURAL EXPERIMENT STATION,

AT WOOSTER, OHIO, ON

THURSDAY AND FRIDAY, JUNE 16 AND 17, 1904

INTRODUCTION

At the annual agricultural convention, held at Columbus in January 1903, the farmers' institute lecturers of the state formed an organization and planned a summer meeting, to be held in June at the Experiment Station. Invitations to attend this meeting were extended to the members of the State Board of Agriculture; the

officers of the State Horticultural Society; the faculty of the College of Agriculture, Ohio State University; to representatives of the United States Department of Agriculture; of the Agricultural press and of the Ohio State Grange. The meeting was held June 18th and 19th, and addresses were made as follows.

"Ohio and her Farmers' Institutes," by Dr. W. I. Chamberlain, Editor Ohio Farmer.

"Legislation in the interest of Agriculture," by Hon. T. E. Cromley, President Ohio State Board of Agriculture.

"The relation of the State to Agriculture," by Hon. W. W. Miller, Secretary Ohio State Board of Agriculture.

"The relation of the General Government to the state farmers' institutes," by Prof. John Hamilton, Farmers' Institute Specialist, U. S. Department of Agriculture.

"The Ohio College of Agriculture," by Prof. John W. Decker, Ohio State University.

"The Ohio State Horticultural Society and its Work," by W. W. Farnsworth, Secretary Ohio State Horticultural Society.

"Organization in the interest of Agriculture," by John Begg, President Ohio Association of Farmers' Institute Workers.

"Leaves from a Worker's Note-book," by S. H. Ellis, Past Master Ohio State Grange.

Impromptu addresses were also made by Hon. A. W. Jones, ex-Lieutenant Governor of the State, by Alva Agee, President of the Board of Control of the Experiment Station, who acted as presiding officer of the meeting, and others.

Unfortunately, no stenographic report of these addresses was secured; but there seemed to be a general feeling that the meeting had served a very useful purpose, and the hope was expressed that it might be followed by similar meetings in the future.

In response to this expression, the Board of Control of the Experiment Station issued invitations to a similar meeting, which was held at the Station, June 16 and 17, 1904. Following is a report of the proceedings of this meeting:

Thursday evening Session.

The second annual reunion of the Ohio State Agricultural Institutions met and was called to order by Director Charles E. Thorne, who said:

LADIES AND GENTLEMEN:—On the part of the Board of Control of the Experiment Station and of the State Board of Agriculture, I wish to express our hearty appreciation and pleasure at having your company this evening. This, the second of our annual gatherings, we hope may be but one of many successive reunions.

The times are changing in all lines of human industry, and in none more than in agriculture. Mechanical invention has accomplished the most that it will ever do for agriculture. There will be improvements in farm machinery in the future, but no flight of fancy can conceive of improvements that shall bridge such a chasm as has been bridged by the transition from the sickle, the wooden plow and the flail of our fathers, to the machinery which does our work today.

The progress of agriculture from this day, henceforth, is to be along the lines of intellectual achievement. We have crossed the Rubicon which separates the kingdoms of brawn and brain; henceforth and forevermore agriculture will be ruled and directed from the kingdom of brain.

We have here tonight the men who, more than any other body of men which could be assembled together in Ohio, will be responsible for the direction of the agricultural progress of the near future—the representatives of the State Board of Agriculture—that body which, first springing from the organization of county agricultural societies under legislative enactment of 1832, organized as a corporate body under the style and title of The State Board of Agriculture in 1846 and 1847. It has from that day to this led in the material agricultural interests of our state. It was charged primarily with the management of the great Ohio State Fair, an institution of which every citizen in Ohio who is acquainted with its history is justly proud; but today the State Board of Agriculture has greatly enlarged functions, which will be explained to you by Secretary Miller.

The Ohio College of Agriculture was organized in 1872, and for twenty to twenty-five years made but slow growth, but it was spreading its roots throughout our educational system, until today we have a College of Agriculture of which we are as proud as we are of the Ohio State Fair.

The Ohio Agricultural Experiment Station was organized in 1882; and the great force of Farmers' Institute workers was organized at about the same time, under the charge of the State Board of Agriculture.

The Agricultural Press is of course a proprietary organization, but one which has done and is doing wonders in the development of agriculture; and in the development of that industry no agency has been more useful than the farmers' organizations.

All of these various bodies, state and independent, are represented here tonight, and through these various lines of organized endeavor must come the progress which agriculture is to make in the coming future.

Two years and a half ago, in a paper which I read before the Annual Meeting of the State Board of Agriculture, at Columbus, I produced statistics, compiled from the annual collection by the assessors of our state, which showed that while we have made some progress in increasing the yield per acre of our wheat fields, our corn fields are today producing less grain per acre—no more grain per acre, speaking with the utmost circumspection—than they did fifty years ago. I showed that during the first half of the fifty years covered by these statis-

tics, our live stock had kept pace with the increase in acreage of corn and wheat, but that during the latter half we have constantly been losing in the number of domestic animals kept in the state, until, at the close of the half century, our domestic animal population, as numbered on the basis of potential manure production, is no greater than it was fifty years ago.

These figures mean to me that the agriculture of Ohio, taken as a whole. is at a standstill, or actually retrograding; it means to me that the men in whose hands is placed the enormous responsibility of pointing out the better way, have a great duty to perform, a responsibility which we cannot too seriously consider.

I have hoped that in the discussions which might take place during this short evening we might at least get some suggestions which would serve as seed thoughts for future endeavor; which might in some way lead toward a higher attainment in our agriculture.

All these organizations—these state organizations especially—of which I have spoken, have their part to perform in this work. The State Board of Agriculture must continue in the future, as in the past, its care for the material interests of the farmer. The College of Agriculture will never have fulfilled its mission until it has its roots implanted in every school district in Ohio. In some way, somehow, it must reach the very remotest corner of our state before it shall have attained the mission which is laid upon it. The Experiment Station, likewise, must extend its work until every neighborhood in our broad state is reached; in some way, somehow, these ends must be attained.

It is a great deal easier to see and to say what ought to be done than to see how it is to be done. The *how* is what we want to reach tonight; with our faces set steadfastly forward, therefore, let us look toward the future and see what we can do, what we can suggest, that may be helpful to the work which lies nearest to the hearts of all of us.

As the first exercise on the program for this evening, we have "The Growing Work of the Ohio Department of Agriculture," by Secretary W. W. Miller, whom I have great pleasure in introducing to this audience.

THE GROWING WORK OF THE OHIO DEPARTMENT OF AGRICULTURE.

BY SECRETARY W. W. MILLER.

MR. CHAIRMAN, LADIES AND GENTLEMEN:—I had hoped not to be placed on the program this evening, as I was on it a year ago, but Professor Thorne made use of the long distance telephone and said that I had been drafted for duty and assigned me a topic close to my heart and close to my daily work, so I did not think it would be good treatment to refuse.

The Ohio State Board of Agriculture, the creator of, and sponsor for, the Ohio Department of Agriculture, began its work of education and organized interest in agriculture in a very modest way, and has achieved some measure of success by hard work, persistent effort, unswerving integrity and loyalty to the great interests it was created to serve. During its life of nearly sixty years, the Board has, at times, been criticized, but never charged with dishonesty or disloyalty. The present members take just pride in the work already accomplished in the betterment of agriculture, and all that pertains to agriculture in its broadest and most comprehensive sense, and is thoroughly imbued with a desire to do still better and more intelligent work in the future.

A "State Agricultural Convention," well attended by representative agriculturists from all parts of the state, was held in the Senate Chamber, Columbus, June 25-26, 1845, which passed some stirring resolutions; among them, the following:

"Resolved, That the next General Assembly be requested to enact a law providing for the election by, delegates from the different county or district societies, of a permanent State Board of Agriculture, to consist of seven members, residing in different parts of the state, who shall have the general supervision of all plans for the promotion of agriculture throughout the state, give instructions for the management of county or district agricultural societies, and obtain reports from the same, procure analyses of soils, lectures, etc., and generally perform such acts as tend to promote improvements in agriculture, horticulture and domestic industry, also make an annual report to the legislature, embracing an account of their own proceedings, together with an abstract of the reports from the county societies."

"Resolved, That a State Board of Agriculture consisting of nine members be elected by this convention, who shall discharge the duties of said Board, as contemplated in the preceeding resolution for one year, or until their successors be appointed."

"Resolved, That a committee of ten be appointed by the chair to nominate to the convention suitable persons to constitute said board."

The convention proceeded to elect a State Board of Agriculture, composed of the following named gentlemen: M. L. Sullivant, Samuel Medary, Franklin; Allen Trimble, Highland; Greenbury Keen, Portage; Samuel Spangler, Fairfield; Darius Lapham, Hamilton; Dr. J. P. Kirtland, Cuyahoga; J. H. Hallock, Jefferson; Joseph Vance, Champaign.

On the 22d of October, 1845, in response to a call issued "By the advice of Messrs. Ridgeway, Medary and Sullivant," there was a meeting of the self appointed "State Board of Agriculture," at which it was decided to prepare memorials, petitions, etc., for presentation to the next general assembly. The "Board" adjourned until December 10th, on which date the committees on agriculture of the two branches of the legislature were present, "and a full and free interchange of opinions was had in regard to the several plans for the promotion of agriculture, contemplated in the resolutions and memorial of the state convention, and the petitions daily coming in from different parts of the state asking for legislative action in behalf of agriculture." On December 15th, 1845, Mr. Wetmore presented to the senate "A Bill for the Encouragement of Agriculture," which, with some changes, was enacted into law February 27th, 1846. This law created The State Board of Agriculture, consisting of fifty-three members. Its provisions in relation to county societies were very similar to the provisions of the law now in force, requiring reports to be made to The State Board of Agriculture, the holding of an annual state meeting, etc.

February 8th, 1847, the law was so amended as to provide for but ten members of the board, five to be elected annually for terms of two years. January 13th, 1898, the law was again amended, by providing for the election of two members annually for terms of five years. At the annual meeting of the Board, December 6th, 1848, it was resolved to hold a State Agricultural Fair in 1849, but owing to an outbreak of cholera during the summer, it was postponed. On the 5th, 6th and 7th days of October, 1850, the first Ohio State Fair was held at Camp Washington, near Cincinnati. The fair was "moveable" for some years. Fairs were held in Columbus in 1851; Cleveland, 1852; Dayton, 1853; Newark, 1854; Columbus, 1855; Cleveland, 1856; Cincinnati, 1857; Sandusky, 1858; Zanesville, 1859; Dayton, 1860-1861; Cleveland, 1862-1863; Columbus, 1864-1865; Dayton, 1866-1867; Toledo, 1868-1869; Springfield, 1870-1871, Mansfield, 1872-

1873. In 1874 the State Fair was located in Columbus, occupying the grounds of The Franklin County Agricultural Society until 1886, when it was permanently located on its own beautiful grounds, just north of the city. The board has held fairs annually since 1850, except in 1888, when the "Ohio Centennial Commission" was authorized to and did hold its Exposition on the State Fair Grounds.

The receipts of the first fair, 1850, were eight thousand and thirty six dollars and eighteen cents ($8036.18). The receipts of the last fair, 1903, were forty-nine thousand eight hundred and forty seven dollars and fifty-six cents ($49,847 56). Thus you will easily appreciate the fact that the work of the State Fair is "growing".

In 1850 the Board had no assets other than a determination to do all in its power for the benefit of agriculture. In 1904 the Board has in assets probably the finest and best equipped fair grounds, all things considered, and the best appointed agricultural offices, to be found anywhere; an appropriation of fifty thousand ($50,000) dollars, to expend in betterments to the State Fair Grounds; a considerable balance in bank, and an exalted ambition to be of service to agriculturists, particularly, and the whole people, generally.

In 1880 the Board organized a corps of about eight hundred volunteer crop and stock reporters, and published reports quarterly, for general distribution. After the Board had inaugurated the work and demonstrated its ability to handle it, the General Assembly enacted a law directing the Secretary of Agriculture to collect and publish crop and stock statistics monthly, and requiring the state printer to print the same promptly, as preferred matter. Still later, the General Assembly enacted a law requiring the county auditors of the state to compile the agricultural statistics returned by township assessors, and report the same to the Secretary of Agriculture, for publication and distribution. This division of the department of agriculture is doing such excellent work that it is commended, approved and appreciated by agriculturists generally, and is regarded by the leading boards of trade as the most authentic crop and stock report issued by a state Department of Agriculture.

In 1881, at the instance of the Board, the General Assembly enacted a law creating the Secretary of the Board inspector of commercial fertilizers, and authorizing him to issue licenses to sell, analyze samples, publish the results, and to have general supervision of the sale of commercial fertilizers in the state. This work has been successfully pursued, with most satisfactory results to consumers and manufacturers; it has grown gradually from very small to very large proportions, and requires a great amount of labor to secure and analyze samples, estimate and determine fair commercial valuations, publish reports, and conduct the immense correspondence of the division.

The material benefits of this Division to agriculture have been so great that I hesitate to estimate them; it is fair to say, however, that millions of dollars have been saved by the farmers of Ohio, by reason of the information they have received from and through this Division of the Ohio Department of Agriculture.

The first suggestion I have been able to find relative to lectures for the benefit of farmers, is from Dr. N. S. Townshend. Under date of February 15th, 1845, he wrote as follows:

"Had we a State Agricultural Society, with a good board of managers, or should the legislature constitute a State Board of Agriculture, then either of these might select a sufficient number of competent individuals to lecture, after the manner of medical institutions, on all the sciences having relations with agriculture. To one lecturer, might be assigned geology and mineralogy, with their relations to draining, well-digging, etc.; to another, chemistry, with its

innumerable applications; to another botany and vegetable physiology as applied to gardening, orcharding and field culture; to another lecturer, zoology, comparative anatomy and physiology, showing their bearing upon the management of domestic animals; to another, the principles of pathology and therapeutics, and their relation to the treatment of the diseases of animals, and all the operations of a surgical nature which the farmer is required to perform; then to another, natural philosophy and the application of its principles in the perfecting of farming implements, etc., etc."

October 15th, 1846, Mr. M. B. Bateham (later a member of the State Board of Agriculture) said: "In regard to lectures, we hope that the State Board will take some action upon the subjeet, and that several competent persons may be engaged to lecture in different parts of the state, where desired, during the coming winter. We know of no way by which more good could be accomplished at the present time."

The Ohio State Board of Agriculture, at its second meeting, held October 24th of the same year, adopted the following resolutions:

"Resolved, That this Board earnestly recommend the formation of township and neighborhood farmers' clubs or societies, for the purpose of mutual improvement by means of libraries of agricultural books and periodicals, and discussions and lectures upon agriculture."

"Resolved, That this Board respectfully and earnestly ask gentlemen possessing the requisite knowledge of science and agriculture in different parts of the state, to assist in the great work of promoting agricultural improvement, by delivering lectures to farmers, as they may be desired or have the opportunity, especially during the season of fall and winter, and in places where clubs or societies may be formed for such purposes."

Ex-Governor Allen Trimble, president of the State Board of Agriculture for several years, in his report to the Board for 1848, said:

"I cannot close this report without again calling the attention of the General Assembly and our farming population to the importance and necessity, if we should succeed in our undertaking, of elevating agriculture among us to its true dignity and importance, by providing some efficient means for preparing our young men, at least, for adopting a more improved and perfect system of agriculture."

In 1880 Dr. W. I. Chamberlain was elected secretary of the State Board of Agriculture, and in an address to the Board, made September 14th of that year he asked for definite authority "to co-operate with county or other local agricultural societies and granges in calling and organiziug farmers' institutes or agricultural conventions during the fall and winter."

The Board at once adopted a resolution appropriating one thousand dollars ($1000) out of the earnings of the State Fair for the purpose of inaugurating farmers' institutes in Ohio, and during the winter of 1880-81 the good work was begun, by the holding of twenty-seven successful institutes. The number increased gradually unil 1889-90, when sixty-two meetings were held. During the winter of 1889-90 the General Assembly, recognizing the value of farmers' institutes, passed a law making a liberal provision for their support, thus enabling the board to largely increase its work. In 1890-91 the Board conducted one hundred and twenty-four institutes. The Farmers' Institute work in Ohio has gradually increased, both in scope and popularity, so that the Board now conducts an average of two hundred and fifty two-day institutes, annually, with two state speakers on duty at each. There are also held in the state an average of fifty interesting, well attended, independent institutes. We have between thirty and forty intelligent, educated, earnest, up to date farmers, who are doing good and

acceptable work as institute lecturers, with sixteen thousand seven hundred and fifty dollars ($16,750) available annually, for paying expenses. Ohio conducts more Farmers' Institutes than any other state in the Union, and I trust that we are doing as good work as our sister states.

May 7th, 1902, the General Assembly passed an act constituting the Ohio State Board of Agriculture the State Board of Live Stock Commissioners. The Board organized by electing a president and secretary, and appointing Dr. Paul Fischer State Veterinarian. The State Veterinarian is subject to the rules and regulation adopted by the Board. When necessary, additional veterinarians are employed.

To the Board is delegated power to prescribe rules for carrying into effect and enforcing all the laws of the state with reference to the protection of the live stock and exterminating disease; and it is authorized to, and does, cooperate with the Bureau of Animal Industry of the United States Department of Agriculture. The scope of the Board's work is entirely administrative in character, the object being not to treat disease, but to prevent its spread and provide means for eradication. Prevention is brought about, as far as possible, by enforcing the laws forbidding the transportation of diseased animals through or into the state, and by regulating the sanitary condition of stock-yards and railway cars and other conveyances used for transporting animals; and also the condition of buildings and public and private premises where live stock may be quartered.

When dangerously infectious or contagious diseases break out their spread is checked by enforcing strict quarantine regulations. In enforcing these regulations and in receiving information regarding outbreaks of dangerous diseases the co-operation of live stock owners and transportation companies is of the greatest value; in fact, without such co-operation no effective work can be done.

Animals affected with dangerous, infectious or contagious diseases, the spread of which can be controlled by isolation of the infected animals, are strictly quarantined until all danger of commuication has passed. The cost of quarantine is always borne by the owners of the quarantined animals.

Shipments of live stock into the state, and cars or other conveyances carrying such live stock, are subject to inspection by the state veterinarian whenever this is deemed necessary to the enforcement of the rules and regulations of the Board. The state veterinarian is authorized to issue eertificates of health for animals to be shipped to states requiring such certificates.

When, in the opinion of the Board of Live Stock Commissioners, it is necessary, to prevent the spread of any dangerous, contagious or infectious disease, to destroy certain affected or exposed animals, such animals, after being examined by the state veterinarian and pronounced affected with the disease in question, may be ordered destroyed. For animals thus destroyed the owner may receive compensation from the state. Claims must be approved by the Board of Live Stock Commissioners, reported by the Board to the Governor, and by him communicated to the legislature with the recommendation, if the matter is approved by him, that the proper appropriations be made to pay such claims. Thus far this provision of law has been applied to glanders in horses and mules, and rabies in swine only.

The seventy-sixth General Assembly appropriated four thousand two hundred and thirty dollars and nine cents ($4,230.09), to pay owners of horses and swine destroyed by order of the Board during the past year. This action of the General Assembly, the first of its kind in the history of the state, will be of inestimable value to the Board, in its efforts to protect the live stock interests of the state.

And I am happy to say, Mr. Chairman, that Senator Renick W Dunlap, who is present with us this evening, aided the State Board of Agriculture and other agricultural interests in the state greatly in securing appropriations, and securing proper and needed legislation.

This appropriation has done much good to agriculture, in my opinion, because it has clinched the fact that payments will be made. Every man whose animals have been destroyed for the public good has received his pay.

May 10th, 1902, the General Assembly authorized the creation of the Division of Nursery and Orchard Inspection in the Department of Agriculture. Mr. A. F. Burgess was appointed chief inspector, and six assistant inspectors were appointed. This division is accomplishing great good by inspecting and controlling the sale of all nursery stock, and inspecting orchards, shrubs and vines, and prescribing and enforcing treatment to prevent the spread of dangerously injurious insect pests and plant diseases.

The seventy-sixth General Assembly, 1904, enacted a law to regulate the sale of commercial feed stuffs in Ohio, and charged the secretary of the State Board of Agriculture with its enforcement. This is one of Senator Dunlap's bills—it took him the whole session to get it through the General Assembly. A "Division of Feed Stuffs" has been created in the Department, and the work of licensing the sale, and securing and analyzing samples of feed stuffs begun. It is believed that much good can and will be accomplished by this division.

Prior to 1880 the work of the State Board of Agriculture consisted in holding State Fairs, and preparing and publishing annual reports, containing compilations of agricultural statistics, abstracts of reports from county agricultural societies, addresses and lectures on agricultural topics, and the proceedings ot the annual meetings of the Board.

Between 1846 and 1880 the secretary of the Board conducted a general correspondence regarding agricultural affairs, but the principal work of the Board was the holding of State Fairs. A secretary and clerk constituted the permanent office force of the department. The annual appropriations made by the state, for the expenses of the department, were usually about four thousand dollars ($4,000).

The present force of the department consists of more than twenty people, and the state makes annual appropriations of twenty-nine thousand dollars ($29,000) for the expenses of the department, besides furnishing all stationery, office supplies, printing, etc. In addition to the appropriations, the department receives considerable revenues from license fees from the sale of commercial fertilizers and feed stuffs.

As already intimated, the Ohio State Board of Agriculture hopes to continue the enlargement of its usefulness to agriculture in many ways. Surely there is still much that can be enlarged and improved.

"The growing work of the Ohio Department of Agriculture" I hope is manifest.

CHAIRMAN THORNE: I am sure we are all very much pleased with the address of Secretary Miller. He has given us information useful to all of us as farmers of Ohio.

I am glad to say we have with us tonight the dean of our College of Agriculture, who will now address us on "The Ohio College of Agriculture and what we hope for it."

THE OHIO COLLEGE OF AGRICULTURE AND WHAT WE HOPE FOR IT.

BY PROFESSOR HOMER C. PRICE.

MR CHAIRMAN AND LADIES AND GENTLEMEN:—I do not believe our chairman could have chosen a subject upon which it would be easier for me to speak than the one assigned me.

It is natural for each of us to look to the future and to plan for the future. The future is so plastic, it is so easy to mould our ideals as we would like to have them, without any regard to the stern realities of the present.

The Ohio College of Agriculture has never made a phenomenal growth, but from an enrollment of forty-one in 1895, it has reached an enrollment of two hundred and fifty-five this present year.

As our chairman mentioned in the opening, it took twenty-five years for the roots of the college to become established and for growth to begin, but the growth has begun, not such a rapid growth, but a growth which we believe is healthful, and a growth which is permanent, the increase being something like ten per cent. each year.

During this growth the standard of the work has been increased until today our college offers six different courses of study: Three four-year courses, which are regular collegiate courses: a four-year course in agriculture, a four-year course in horticulture and forestry, a four-year course in domestic science; two two-year courses, a two-year course in agriculture, a two-year course in domestic science and a two terms special course in dairying, ten weeks each winter for two winters.

I believe that our college has courses of study which are as well arranged as are those of any college in the country, and in fact I do not know of any or but very few that equal it. I think this is due to the efforts and the work of Professor Hunt, my predecessor, who is a thorough teacher and had a thorough appreciation of well arranged, logical, well-prepared courses. I think that a just criticism which falls upon many of our agricultural colleges is the illogical arrangement of their courses of study and the manner in which they are given, but that will not hold true I think of our college.

We can not say as much for our equipment. Our equipment has not been kept up and one of our hopes for the future is that we may have greatly improved equipment, especially in the matter of farm buildings and in live stock, in some lines of dairy work and in horticulture and forestry.

With improved equipment I hope and we all hope for a larger number of students, and I think we have a right to hope for more students of agriculture. I hope that in a very few years we may have a thousand students in the college of agriculture. Today we have two hundred and seventy-six thousand farms in the state and we have three hundred and fifty thousand children in the rural schools of the state. Our state has over thirteen hundred townships, and I do not believe it is expecting too much for us to look forward to having a thousand students studying agriculture, and I believe that we will have them.

One thing for which I hope for the future, and to which our chairman referred, is the extension of our agricultural work into the rural schools of the state. I believe that our mission will not have been performed until we shall have extended it into the rural schools throughout our state.

A small beginning has taken place along this line. Last year, under direction of the Agricultural Student Union, a rural school agricultural club was formed down in Clarke county. It was a township club and its work proved so satisfactory that this year it was decided to take up the work again. The plan of the work is to organize agricultural clubs in the rural schools among the children, for the pupose of trying simple experiments, such as testing varieties of corn or the raising of vegetable gardens or flower gardens, or making collections of wild flowers and weeds, and learning to study nature, and through nature to learn that there is something in agriculture; turning the attention of the children to agriculture; teaching them to see what they look at and to hear what they listen to.

We published a small bulletin this spring, simply to keep the work alive, because we did not have the force nor the means at hand to take it up as we felt it should be taken up, but we felt that it was work that we could not allow to perish. The results of the bulletin were simply astounding. We were buried with applications to take up that work, and we now have nearly two thousand children in the rural schools of the state who are making experiments and working in the agricultural clubs, carrying on work under the direction of the College of Agriculture, and I see for it a great future. I think we could very easily have twenty thousand children enrolled in this work, and when we can organize these clubs in every county and in every township of the state our rural school children will take an interest in agriculture, and when we can get them interested in agriculture they will naturally turn to the college of agriculture for their education.

The problems of agriculture will be solved by education largely. Director Thorne has said that our period of mechanical invention is probably largely past, and it is now a problem of brains, and we must have education; we must have educated farmers in the state to grapple with the agricultural questions of the day.

Another thing for which I hope, is that our college of agriculture may come in closer touch with the farmers of the state and that the farmers of the state may come in closer touch with the college of agriculture. I believe that we need to be nearer the farmers and we need the farmers to get nearer to us.

This can be done by having the farmers come to us—and the invitation always stands open for agricultural organizations to meet on our campus, to meet in our buildings, in our class rooms, and we welcome agricultural organizations to meet with us; we welcome the farmers of the state to visit us, and we invite them and ask them to come and examine into our work.

Another line in which we can come in closer touch with the farmers is by going out to them in institute work, bnt we are not in position to do much of this. We do not have the time for institute work; we can not go out and leave the students that we have in our college. I feel that our first work is for them, and that we must give the best instruction that we can to the students that have come to us. But through the institute workers of the state our college can be brought before the people of the state. I think that this is done very largely, and we appreciate it and would be glad if the institute workers of the state would familiarize themselve more with the work of the college—investigate the work of the college and bring it before the attention of the people who attend the institutes.

Briefly, then, I may say that we hope for better equipment; we must have better equipment. We hope for more students, and I think we will have more students. We hope for agricultural extension in our schools,—to come into closer touch with the rural schools, and enroll them in the work of studying agriculture.

CHAIRMAN THORNE: We are certainly again informed as to the work of our College of Agriculture; we surely have Dean Price to thank for the new light which he has thrown upon that work.

We shall be glad to hear from any member of the meeting tonight, any one who has any suggestions to make regarding either of the papers which have been read. I know that I can speak for Secretary Miller and for Dean Price, in saying that either one will thankfully receive any suggestion which may go toward strengthening his work, and I know that the audience here tonight is one which if it criticizes will criticize in the spirit of the purest friendship, and such criticisms are always helpful.

If there is no discussion we will pass on to the next subject, "The Ohio Farmers' Institute; What Shall Its Future Be?" by Doctor W. I. Chamberlain.

THE OHIO FARMERS' INSTITUTE; WHAT SHALL ITS FUTURE BE?

BY DR. W. I. CHAMBERLAIN.

MR. CHAIRMAN, AND ALL OF YOU, MY GOOD FRIENDS: When Director Thorne wrote me at the last moment, almost, that he wanted to put me on for this subject, and the same day I received the program, with my name already printed upon it (Laughter) I thought he was "a little too previous," but he assured me that I was not expected to give a paper nor a set address but simply to open the discussion. Indeed I have had no time to write a paper or prepare an address.

In asking what the future of the Farmers' Institutes will be we naturally turn to the past. Was it Patrick Henry or some other great statesman who said "I have but one lamp by which I can judge of the future, and that is the lamp of experience?" We want to know a little of the history of the Ohio Farmers' Institutes, more than Secretary Miller has given.

The Institute in Ohio has been an evolution and a development. Secretary Miller has shown that the idea of the Institute, the first germ, so far as we can learn, originated in Ohio, but it lay almost dormant from 1845 until 1880, and then some actual work was done because definite authority was asked and given to prosecute that definite work. They had talked about it; they had beat about the bush; up until that time Ohio had held some three or four agricultural meetings each year, and Michigan had held three or four and had even called them "Farmers' Institutes," and Massachnsetts had held three or four, and Vermont had held, perhaps, three or four, and Connecticut had even been claiming that the idea originated with that state; but Secretary Miller has shown that the idea originated with Doctor Townshend—honored name!—in 1845, and was developed here though not carried out to any great extent—earlier than in any other state.

But while we do not so strenuously claim the origination of the *idea* of the Farmers' Institute we do claim the origination of the *expansion* idea. We said, if a Farmer's Institute is a good thing in two, three, four, five places in the state then it is good in thirty places as we had the first year, 1880-1881, or in three hundred places as every year now; and that was the development of the expansion idea of Farmers' Institutes; and no state and no man can strip the state of Ohio of the glory of that idea. It belongs to Ohio.

Mr. O. P. Chaney was the man, who, so-to-speak, put his hands into the pocket of the State Board of Agriculture and took out a thousand dollars of the

state fair surplus and put it into Hayden's bank and said to the secretary "Take that and establish the Farmers' Institutes,"—for if you want anything in this wicked world you have to back it up with money.

I say that idea belongs to us—the expansion idea. We said it is easier to take Mahomet to the mountain than to bring the mountain to Mahomet. We said "To the poor, the gospel shall be preached," in the words of scripture, almost; for in the two or three institutes which had been previously held in Ohio and in other states the rich, the educated farmers, the leaders in agriculture, came and conferred and went home, and the poor farmers—poor in pocket, poor in administrative ability and poor in the results of their farming—were left just where they were before. But the gospel of agriculture was preached, under the new dispensation, in all of the rural districts as it is today; then there was an awakening in agricuture.

Ohio, then, first gave the idea of expansion; it first trained the speakers for Farmers' Institutes and sent them out into many other states when they established their institutes.

I remember that when we had been running our institutes for three or four or five years—I can't say which—Secretary Morrison of Wisconsin had succeeded in getting a large appropriation from the legislature for the establishment of some institutes there and he sent for all the information we had, and I sent to him nearly every circular that we had issued, nearly every program and document down to date, and he modeled the Wisconsin institutes, with a few changes, upon our institutes in Ohio. That was the second state that adopted the idea of carrying the gospel to the poor at their homes, in their own country regions, and not simply going out to a few of the better class of farmers.

That idea has now spread into nearly every state and territory of the union—the Ohio Idea of the expansion of agricultural knowledge and instruction.

The question now is shall Ohio, the Mother of Presidents, Father of Farmers' Institutes, continue to send presidents of the United States forth from her borders; shall she continue to stand in the vanguard, in the foreground, in the work of Farmers' Institutes, and if so, what shall the future of our work be?

I am bound to say that many of the states which have taken their cue from Ohio have in some respects done better than we have, better, at least, for their locality. For example in Maryland. Some of our state speakers have gone there and assisted them in their work; they have been the wheel-horses of the work in Maryland. In that state three or four competent specialists go to a place. The manager of the institutes, Mr. Amos, prepares the program, maps out the work, makes the appointments, acts as chairman or appoints a chairman, and they open a school of instruction for the people. The young people do not come, the ladies do not come to any extent. Mr. Gould told me that after coming back from Maryland he was greatly disappointed with the work; that a score or two of farmers would attend the institute in some big county town, while hundreds of other farmers would hitch their horses along the street, and they were trading horses or swapping opinions on politics and not attending the institutes. He was greatly discouraged in that respect, and if you remember quite a little discussion was had in some of our agricultural papers.

Manager Amos was quoted as saying that if they had small numbers they were comforted by the fact that they could match brains against frivolity, referring to our more entertaining forms of institutes in Ohio, and when the one who started the discussion suggested that their "brains" came chiefly from Ohio, as was the fact, they thought it was quite discourteous.

That kind of institute is perhaps best adapted to the conditions in Maryland, where the ladies and young people, as Mr. H. P. Miller was saying lately to

me, do not take special interest in farm matters; and the same is probably true of Minnesota, where the Norwegians and the Swedes and the Danes largely make up the population, and where the manager must carry a force of lecturers and carry on the work in that independent way; and the same to some extent is true in some of the other states, no doubt, But for Ohio it seems to me that the idea of the institute which has been slowly evolving here is really the best idea; to bring the whole family, so far as possible, together and make it a truly democratic organization, managed from the central office in Columbus, but with their own president, with their own local workers and with a large body of of earnest seekers after greater knowledge, with but two or three competent lecturers and instructors. That is our idea in Ohio.

How shall we make it better? My first thought is that in our institutes we must have more definite information and instruction in the future, and it must be accompanied also by inspiration and incentive to do better work, for no matter how well you may inform the people unless you inspire them to do better work it is of no avail.

The old colored man, you know, when asked his system of sermonizing, said "In 'de fi'st place, breddern, I reads 'de text; and 'den I 'splains 'de text; 'den I 'spounds 'de text; and 'den I puts in 'de rousements." And so I say, brethren, we must not only bring information and instruction to the farmers, but we must bring incitement to better work, and that is what I believe is done better in Ohio than in any other state with which I am acquainted.

This information and instruction must be of two general characteristics or classes; it must be based upon scientific truth, but it must be eminently practical.

Who shall give the practical instruction? I believe that it must be chiefly actual farmers; and, second, it must be given by farmers who are successful, along one, two or three special lines in which they have proved themselves to have won greater success than their neighbors have done in those one, two or three specialties.

In the next place, however, they must employ their own actual, absolute knowledge; for you know that food in order to stimulate growth must be assimilated and digested, and that knowledge in order to be of any avail to an audience must come from the man's own absolute experience; that he must, if he has read it from books, have thoroughly digested it and tested it and proved it to be true. Book knowledge alone will not do. To illustrate, I refer to my own custom. I have largely, always confined myself in my writings and in my lectures in Farmers' Institutes, to the things which I am conscious that I have digested from my own inner experience and outer observation—the things that are my own.

I was telling Mr. H. P. Miller and one or two others, at table, of a story which I hadn't thought of for years, of an old man who sat right down in front of an Episcopal rector in old England, where they "borrow" their sermons a great deal, you know—where they go into the ministry for revenue. He sat right in front of this rector, I say, and to his first eloquent paragraph he said distinctly "That is Dean Swift;" and pretty soon a well rounded sentence came out and the old gentleman spoke up in that clear, sharp voice which could be heard all over the church, and said "That is Sidney Smith;" and another fine paragraph came out and he said "That is Robertson." They could hear him all over the church, and by that time the rector was pretty well aroused and he leaned over and said "Old man, if you don't stop disturbing the service we will put you out." "That's his own," said the old gentleman (Laughter). And so I say that an institute speaker must give what is *his own*, even if it isn't so good as what he might borrow.

And here I want to digress long enough to speak of the evil of telling mere stories. If a man has a good story of his own that comes in pat in illustrating some point, it is all right. After I came here today, Professor Selby told me that once at a Tiffin institute a certain gentleman, who is not on the lecture force now, told a pretty good story, and an old gentleman sitting right next to him (Professor Selby) leaned over and said "Secretary Chamberlain told that story here ten years ago." Pretty soon the lecturer told another story and the old gentleman leaned over and said "Chamberlain told that seven years ago here." A gentleman in Ravenna told me lately that Secretary Brigham, some five years ago told two good and pat stories which came in naturally to illustrate his point and carried force with them, and he said that at every institute since some lecturer had repeated these two stories of Mr. Brigham's until it fairly nauseated them.

I say a man's work must be his own, and so I have tried to confine myself to my own knowledge—my own work upon my orchard; I have put forty years upon that, of study and of thought; my own work upon my barn; I have put forty years upon that, of study and of thought, and I have borrowed the best ideas on barn and orchard I could find anywhere, and in addition I have put into it my own experience. And so I am willing to speak on barns and barn architecture; I am willing to speak on the raising of heifers for others to milk; I am willing to speak on the raising of seed potatoes and oats and wheat and what-not for others to plant; and I am willing to speak on clover, fertilizers, tillage, and on anything on which I have a practical knowledge of my own.

I believe that the speakers at our state institutes should each year map out some new and definite work and say "Now, this work this year I will do better than I ever did before, and if possible I will do it better than any of my neighbors are doing, and when I get through, if I am called on to lecture I will only give two, or three, or four, or five subjects, but I will give inspiring talks from my own knowldge.

You know the scripture tells of those who "bring forth from their treasures, things new and old." The old things are good occasionally, but at Farmers' Institutes we want things new at any rate, and so I believe that we should be students during the whole year, experimenters during the whole year—the institute force—and be able to bring forth things *new*, to the audience, things that we have discovered and found valuable to us.

A word more in regard to speaking on what we ourselves know thoroughly. I have heard Mr. O. E. Bradfute, with a chart of a beef animal, show just where the sixteen cent meat and the ten cent meat and the twelve cent meat and the four cent meat all come from, all the way through; and I suppose I could have kept that chart, and so clear and so distinct was his statement, that I could have gone through with it, but I should have known all the way through that I was a thief; that I hadn't been through that work myself; I hadn't reared or butchered those beeves; and hence I will not speak on that subject.

I have heard my friend H. P. Miller, at an institute, speak on sheep, and it seemed as if he were born among sheep; and as I had a good deal to do with sheep forty or fifty years ago, when I listened to Brother Miller I thought I could go right out and give that lecture over again, almost from memory. But I wouldn't dare to do it because it is not my own, and because some fellow in the audience who knew more of the latest things about sheep than I did would ask me this question or that question, and then they would find out that I had borrowed from Brother Miller or somebody else and was not up to date. And so it is all the way through.

In regard to science. Who shall give instruction on scientific subjects? My own scientific education is pretty old. Forty-nine years ago I entered the

Western Reserve college, one of the best colleges in Ohio at the time, and forty-five years ago I graduated there. Our chemistry—and I never talk about chemistry at a Farmers' Institute; I know too much, or rather do not know enough—consisted of five or six weeks of lectures from old Professor Cassell of Cleveland, who came down to Hudson and made a number of very bright flashes of light, and a few very loud explosions and created a few very bad odors of smoke in the room, and that was our chemical education; and our botanical education was about as much.. We learned to name a few plants.

We never learned *chemistry*, we learned *about* chemistry; we never learned structural botany, how the plants grow; we learned what their names were and to what classes they belonged.

What the farmer wants to know about chemistry is what it will do for him; what influence does it have upon the fertilizers he uses in the soil? What will structural botany do for me on my farm? How do the plants grow, and how can I help them to grow, better than they now grow? What will geology do for me? Not the long history of the lapse of ages, but the question how the slow disintegration of the rocks and the grinding process of the glacial action has fitted my farm for its specific work, and how I may be able to do better work on my farm? That is what they want to know. What they want to know in regard to this, that or the other insect is not its life history from Adam down to the presnt time, but "how can I kill the blamed thing" (Laughter); how can I poison it before it destroys my apples; how can I make that knowledge practical?"

Then who shall give this information? Not the farmers. The old Latin proverb says "*Ne sutor ultra crepidam*"—"Let the shoemaker stick to his last". And so I say in regard to the men who do not understand the practical details of the various sciences that underlie agriculture. I say with great respect, that when you don't know a thing about the details, or about the fundamental principles, let the scientific men do the work along that line.

I do not wholly agree with Secretary Miller on one point. I asked him "Why don't you send out the Agricultural College men, the Experiment Station men more?" and he said, "In the first place they haven't got the time to go and in the second place, do you know, the farmers some way don't seem to want them." Now, there is partly a mistake in that. There have been men sent forth who would give the life history, for example, of an insect from away off, and when you asked them "what are you going to do about it?" would answer, "Oh, that isn't our concern; we are studying pure science."

I think another reason why the scientific men have not succeeded better when they have not—and some of them have succeeded most admirably, some of our station workers and some of our men from the agricultural college have succeeded most admirably—has been that they seemed to forget that they have only one-half hour on a subject before an audience and then forever are away from them, instead of a full hour before an earnest class of students, in the class room, with all apparatus and illustrations, an hour every day for a whole year; and that at the institutes they must take up some single point or some single application of science and "rub it in," so to speak, lay the foundation well, and say "these are the truths of science; thus and thus they apply to your daily work on the farm." My friends, Director Thorne does that sort of work and he does it admirably when he goes out, and I might name two or three others of the workers of this Station who do that work admirably; and of the workers in the Agricultural College.

I know that they cannot well be spared from their work. As Dean Price said just now, they have their own specific work to do. But I believe it is the business of our legislature to give sufficient assistants in these institutions so

that these men may go forth as instructors in our farmers' institutes, and, with the suggestions that Secretary Miller can give them along the lines that I have named, I am sure that their work will not only be instructive in the highest and best sense but inspiring, leading to better work.

I have only one or two more points to make. One is on the question of entertainment, amusement. I believe in a little music, it inspires; I believe in encouraging the young people and the ladies to be present; I believe in getting the ladies to share in the program; I believe, occasionally—as they did last winter at an institute in Northwestern Ohio—in having a class from some grammar school come in and go through their gymnastic exercises for, say, fifteen minutes. It was an eye-opener to some of the farmers there to know what sort of training the children were getting in the schools, But I do not believe in taking the pet reciter from some high school and have him or her bring on a long elocutionary recitation, often of the lowest sort of common slang, degrading to the taste, funny, perhaps, in a low sense, to be encored by the gallery gods or the rabble, and then come on again and again, destroying the effect of the meeting. That sort of thing I have met only once in two years; thanks to Secretary Miller's letters and circulars of instructions, it is nearly weeded out in Ohio. That is the sort of thing, I suppose, to which Manager Amos referred when he spoke of "brains versus frivolity." We want to throw out the frivolity; we do not want to throw out the slight entertaining features between, perhaps, two solid, strong, serious lectures; we do not want to throw out the social influence that tends to make better men and women and children, as well as better farmers; we do not want to throw out the influences that lift up the home; we do not want to throw out or drive away the ladies and the young people from our farmers' institutes, for they are the life of the Ohio farmers' institutes, and the persons who make them superior to any other institutes, almost anywhere, in my opinion.

I thank you for your courteous forbearance with me, as I have tried to think through these thoughts in your presence.

CHAIRMAN THORNE: The Ohio farmers' institute lecturer should be a man of very large ability if he is to bring the College, the Experiment Station and the Department of Agriculture into contact with the farmers. I think we can hardly give too much thought and too much attention to the work which the institute lecturer is to do, and, therefore, made that a large part of the program for this evening. Mr. Rathbun will follow with suggestions on "Some Qualifications for an Ohio Farmers' Institute Lecturer."

SOME QUALIFICATIONS FOR AN OHIO FARMERS' INSTITUTE LECTURER.

BY REI RATHBUN.

MR. PRESIDENT, LADIES AND GENTLEMEN: This is a subject which I have thought would be profitable if we could have it discussed among the institute lecturers, so that we might be more in harmony, so that we might understand each other better, know something about what each other's thoughts are of some of the qualifications of an institute lecturer; therefore, I wanted a discussion by a number, and in order to get that discussion from others, I myself must be very brief. In order to hold myself down I had to write my thoughts, because many of you know that one of the greatest faults I have is that when I get up to talk there is never any stopping place for me; I just simply have to quit; Brother Ellis suggested at the supper table this evening that I had no use or no

need for any more tongue. So I have made a few notes in order to be brief, and I have made my points very briefly for the reason that I want to hear what are the thoughts of the other institute workers on this subject.

We understand that the Ohio institutes consider more subjects and cover a wider range of thought than in any other state, also the audience takes more part in the program and puts more questions to the speaker, therefore a liberal schooling is necessary and too much cannot be obtained.

He needs a command of language and an expression in speech that will enable him to make plain the subject under consideration, and this command of language does not mean the use of "big words," little used and much less understood. Many people do not grasp an idea they see in print, but readily comprehend it when spoken to them in clear accents and with good emphasis.

It is one of the attributes of the institute lecturer to help such people absorb the information being given out by the various Experiment Stations and Agricultural departments. To this end the national government is wonderfully assisting the lecturers through the office of Farmers' Institute Specialist.

The success of a teacher does not depend on his capacity to accumulate property—although some people consider this alone to be success—but it does depend upon his ability to impart the knowledge he possesses to others in such a manner that they can understand it.

He should be well informed about the work being done by the State Board of Agriculture, the Colleges of Agriculture and Domestic Science at the State University, and by the Agricultural Experiment Station.

He should have as much practical experience with his theory as possible, and if he be a man who has "moved around some" and had experience with different soils and conditions he has a decided advantage over the man who has spent his whole life upon one farm; but if he think he can be a teacher and also do the work of a regular hand on the farm he must soon see his error or fall into the background. No man can perform the physical labor of a regular hand on the farm and at the same time sharpen his mental faculties sufficient to keep in the van of the procession of the American farmers of today. He should not adopt a theory and then study to prove that theory to be correct, but should be searching for new truths and improved methods, even though they do crowd out some pet theory or practice of the past. He should be clear of all jealousy, ready to adopt facts by whomsoever discovered.

He should not go before the farmers purporting to teach only his own practices in all things, but acknowledge that he comes as a promulgator of advanced discoveries also, because his opportunities have enabled him to possess them. On account of the difference in soils, conditions and environments if he teach only his own practices, his field of usefulness is too limited for consideration.

He should not take up the time in complaining about the mistakes or irregularities of the past, but should especially point out some improvement for the future. A good way to destroy bad habits and practices is to give something better to take their place.

He should have stamina enough to defend himself when personally attacked, but judgment enough to recognize that an attack upon a position taken by a speaker is not an attack upon the speaker, and then again, many inexperienced people think the way to discuss a subject opened by a speaker is to tear his remarks all to pieces if possible.

He must recognize that he has before him many people of many minds, some of crude thought and habits and some of ill training. and he must not permit himself to be disconcerted, or get "off his base" because others do not do just as he thinks they ought to do.

CHAIRMAN THORNE: Without taking any more time for discussion now we will hear from a representative of the United States Department of Agriculture, Professor John Hamilton, on "The Relation of the Farmers' Institute Lecturer to Experiment Station Work."

THE RELATION OF THE FARMERS' INSTITUTE LECTURER TO EXPERIMENT STATION WORK.

BY PROFESSOR JOHN HAMILTON.

MR. CHAIRMAN AND LADIES AND GENTLEMEN: When my good friend, Mr. Agee, about nine years ago, last winter, came over to his first institute in Pennsylvania he opened his address by saying, that he was from Ohio, and he was not quite sure whether it was safe for him to come over into Pennsylvania and present a manuscript before a Pennsylvania audience, for he had heard that it was the custom over there to shoot a man who undertook to read a paper. I find that they do not do that in Ohio, so I have taken the privilege of presenting what I have to say in writing.

The act of 1887 establishing the agricultural experiment stations declares, that "it shall be the object and duty of said experiment stations to conduct original researches or verify experiments." After enumerating the classes of subjects respecting which researches or experiments are to be conducted, the act goes on using the following words—"and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states and territories."

The stations, therefore, are, first of all, institutions for conducting researches and investigations in agriculture. The $15,000 which the national government annually appropriates for the support of each station, must be used exclusively for the purpose stated, except, that so much as is needed to meet the expenses of "printing and distributing bulletins or reports of progress," may be used for that purpose, and "five per centum of the annual appropriation" may be spent in the "erection, enlargement or repair of a building or buildings necessary for carrying on the work of such station."

Incidentally, as a result of the methods involved in conducting the research and experiment work which the act prescribes, the stations are "demonstration farms," on which may be seen examples of the effect of different methods of treatment upon animals and crops.

The station may also be an example or illustration of "advanced agriculture" — on which the most improved implements and machinery are in use and the best scientific methods are pursued in conducting its operations. To what extent the model farm idea can be followed, depends in each case upon the character of the subjects that are selected for "research or verification." Where this is the result of, or a feature of, the "research or verification" work, it is a legitimate part of the station's operations. For instance, a model dairy herd may be a feature of an experiment station farm. High bred animals of specially well developed points, horses, cattle, sheep or swine, may be a part of the station equipment. Fields sown with superior seed may be a feature in agricultural experiment station work. Orchards planted with varieties of trees selected because of the superior quality of their fruit are properly admitted upon station ground. Whilst, in all cases, these subjects must primarily be for "research and verification" yet they may also serve the dual purpose of being used for "research and verification," and at the same time be examples of advanced agricultural practice.

The station is also, a "bureau of agricultural information." By the terms of the act it is required to secure information and disseminate it. It becomes, therefore. in a State a headquarters or center of scientific information respecting agriculture, and its officers are expected to stand ready to be consulted personally, or by letter, to answer questions and give information on agricultural subjects. The imposition of these duties makes it a teacher of agricultural science, and it conducts its work of instruction by means of bulletins, by correspondence, and by personal conference.

The stations may act in one or all of the directions indicated, even if they have no funds, other than those provided by the act of Congress.

If, however, as is almost universally the case, the stations are provided with funds in addition to those which congress appropriates, they are at liberty to undertake, in connection with the duties already referred to, such other work as they may see fit. They may become the fertilizer inspectors of their states, or food analysts, or teachers in their agricultural colleges, or institute lecturers, or may engage in general farming. In most of the states the stations have expanded their work beyond the strict limits of "research and verification," and have taken up one or more of the other items to which I have referred. I have given the situation of the stations at the outset, in order that we may have before us, in the discussion of the relation of the farmers' institutes to them, the scope of their work and something of its character.

And now, what is the relation of the Farmers' Institute to these stations and their work?

The Farmers' Institute is a school of agriculture. Like any other school, there are two fundamental requirements necessary to its success. The first is, that there shall be something to teach. Farmers' Institutes were organized in some of the states as long as thirty or forty years ago, but it is only within the past twelve or fifteen years that they have developed into organized schools recognized by the states as a necessary and important part of their system of public education. It was not until after the experiment stations came into existence that the present farmers' institute became possible. Up until that time institute lecturers had but little scientific information respecting agriculture of value to impart. They read essays on general farming, delivered addresses on history or travel, gave personal experiences, sang songs descriptive of scenes in farm life, or declaimed against other forms of industry as antagonistic to agriculture. Careful, scientific and helpful teaching in agriculture by institute lecturers dates from the time when the experiment stations began to furnish reliable information respecting the operations of the farm, and it is from that time men have begun to talk of farming as a "science," aud to make declarations respecting its operations that can be relied upon by farmers as being ascertained truths and not mere individual opinions.

The agricultural colleges were founded in 1862, but until recently their life has been a struggle for existence. It was not until the experiment stations were created in 1887 that the colleges were able to secure and hold classes of young men in agriculture, and it is only now that they are becoming able to furnish courses of study in agriculture that compare, in their culture and educational value, with those of the old curricula of the scientific and classical schools.

The difficulty has been that the agricultural colleges and the farmers' institutes were for years schools with very little agricultural literature worthy of the name to which they could refer, and with almost no scientific data of value in agriculture to teach, We are indebted for the most part to the experiment station for the quantity of valuable information respecting agriculture which we now have, and as a consequence our institute lecturers are now able to interest and instruct their hearers because they have taken advantage of the truths of science which the stations have discovered.

The relation, therefore, of the institutes to the experiment stations is a vital one. The stations furnish life to the institutes. To sever the connection between them is to cut the artery which conveys power from these heart centers to the great body of farming people who are dependent upon this power for their very existence.

I have said that there are two essentials in any well equipped school. One is that which I have just stated—"something valuable to teach," and the other is "competent teachers."

The farmers' institute school is no exception. It too must have competent instructors—capable men and women who have valuable information to impart.

The institute teacher to be worthy of the name must know at least one thing well, and there are but two sources from which this knowledge can come. One is, from personal experience or experiment, and the other is, from the experience or experiments of others. Most men have not had the kind of training that fits them for agricultural experimentation. They have not been taught how, accurately, to investigate the soil, to determine the effects of various methods of treatment upon animals and plants; to know the kind and exact quantity of food material needed for the highest development of various plants. They have not been accustomed to weigh, analyze, and compare results. Experience gained without this careful attention to the causes and conditions that exist is defective in a most important respect. Much of it is guessing at the character of the influences which were at work in producing the results. Not infrequently, in the absence of accurate data, men of equally good reputation for veracity and intelligence have differed radically in their interpretation of results, although their experience was gained in growing the same crops and as far as they were able to judge, upon like character of soil. They depended upon guessing in arriving at conclusions while the man who is to know from personal experience, must not only be an accurate observer, but must test, weigh and analyze results as well.

It follows, therefore, that other things being equal, the trained experiment station expert is ideally qualified for giving instruction in farmers' institutes. He has observed in an accurate way; he has informed himself as to what others have done along simi' .r lines of investigation; he has facts to present. If these facts are important in their bearing upon agricultural practice, and if the investigator have the gift of presentation so as to be able to state his facts in a forceful and interesting manner, he is the kind of lecturer that the institute needs. There will never be an over-supply of such men.

As other lecturers, who have not had the special opportunities and qualifications of the trained investigator, approach his qualifications, to that extent they become useful as teachers of agriculture. Where, as not infrequently occurs, the lecturer has been shut off from work of the character indicated, and consequently has not had personal experience in accurate experimentation, he may nevertheless qualify himself, in great degree, by making a careful study of the experiment work of others as set forth in the bulletins and reports of the various experiment stations, as well as by making a personal visit of inspection to some station where the special kind of experimentation in which he is interested, is being carried on.

The stations, therefore are a necessity to the farmers' institutes; first, because of their being prepared to furnish skilled teachers from their staffs for the giving of instruction in agriculture; and second, in providing opportunity to lecturers not officially connected with the station work, for study of the methods which the stations pursue. No other institutions are fitted for aiding the farmers' institute lecturers to the extent, or for supplying the special information that they need in their teaching work, as are the agricultural experiment stations of the United States.

The farmers' institute is also a distributing agency of agricultural truth. Vast stores of information valuable to farmers have been accumulated.

Experiment stations have been engaged in conducting investigations and making discoveries in the interest of agriculture for the past sixteen years, and they have been printing the results of their work in bulletins and reports. Since 1887, 6,143 publications have been issued by the stations of the United States, most of them containing valuable information relating to agriculture. A great difficulty hitherto has been that of getting this information into the possession of those who most need it. Books, pamphlets, bulletins, circulars, agricultural reports, have all been tried but with only partial success.

The mailing list of these stations is composed of 500,000 names, a fraction only of our agricultural population. We have over 10,000,000 farmers actually at work out upon the land. These with their families number about 28,000,000, or 35 per cent. of the population of this country. Many, therefore, indeed the great majority, can never see the bulletins which the stations issue, and many who do see them unfortunately do not take the time or the trouble to become familiar with what they teach. The farmer's institute comes to the assistance of the stations with live, capable, energetic men and women who direct attention to the truths which their publications contain, and urge farmers to read the bulletins and put into practice the information which they furnish.

The institute is also a valuable adjunct to the experiment stations, in being a discoverer of the needs of agricultural people.

The free discussion of the farming interests in the institutes brings out the practical difficulties that farmers encounter in carrying on their work. Where these difficulties are important and are inexplicable to the ordinary farmer, the questions are referred to the experiment stations for examination and report. The use of fertilizers, the value and place of certain crops in rotation, the composition and value of cattle foods of various kinds, the effects of deep and shallow cultivation in the growing of the crops, the eradication of weeds through the use of spraying, the control of insects and fungus diseases, are a few of the subjects that the stations have taken up. Almost every institute meeting develops some new difficulty, new at least to the man who has asked for some information respecting it. If the corps of instructors has associated with it an experiment station expert the solution of the difficulty can be given at once, and if unknown, the station officer makes a memorandum of it as being a proper subject for inquiry by the station staff.

The institute, further, furnishes a training school for the experiment station worker. The fact that the station expert is obliged to state what he knows in language easily understood by the average farmer, is valuable to him when he comes to write the bulletins of information which his station issues. He has constantly before him as he writes the audience which that bulletin is to instruct, and, because of his experience as an institute teacher, is likely to be more careful to state its truths in language that will be readily comprehended by those who read it.

The institute is also valuable to the stations in acting as a critic or jury, passing judgment on the value and practical character of their work. Scientific men, particulary the younger and more inexperienced, are liable to grow conceited if they have no capable critic to call attention to the defective features of what they sometimes present as being demonstrated scientific truth, capable of being applied with advantage by the practical farmer. A body of practical men mixed with a few lawyers, physicians, ministers of the gospel, school teachers, college professors, and other experts, such as compose many of our farmers' institute assemblies, has been found not to be the place to air crude theories or to present impracticable methods. Many an institute lecturer care-

less of his facts has learned to his cost and humiliation that institute audiences are not altogether uninformed as to what science has discovered, and has come down from the platform a sadder, wiser and more modest man. The sifting that institute addresses receive, disclosing the wheat and getting rid of the chaff, is a process that is of great service to those who, like station workers, have the responsibility of furnishing facts to farmers. Station men, knowing that their theories and results must be tested not simply in their laboratories and upon their station farms but be subjected to scrutiny by bodies of intelligent, practical men as well, are likely to be more cautious in stating as fact, that which has not yet been thoroughly tested or fully proven.

The relation, therefore, that exists between the farmers' institutes and the experiment station work is one of mutual helpfulness. They are necessary to each other. They are co-ordinate parts of a single system. Both are organized for the improvement of agriculture. They have undertaken to do this—one by discovering and testing truths important in agriculture; the other by disseminating this truth among the farmers who need it for daily use. They are mutually dependent—the institute upon the station for reliable information to present; the station upon the institute for a proper and efficient agent to take the facts which it discovers and show their value and practical character to farming people.

CHAIRMAN THORNE: This subject—the whole subject, comprised and treated in the last three papers—is now open for discussion and we shall be glad to have any remarks which any one wishes to offer. As I have already said it is a subject which ought not to be passed by without discussion, but I am aware that the hour is very late and it may be thought better to postpone the matter until tomorrow and try to begin promptly.

The program for tomorrow, as you will see, includes but two addresses as printed, but I am pleased to say that we have with us Professor J. Warren Smith, the Director of the State Weather Service, who will have a short address to make to us on telephoning the weather forecasts to the farmers, and we shall be very glad to have that in addition to the papers which are already announced.

DOCTOR W. I. CHAMBERLAIN: I am sure we ought to take at least fifteen minutes for the discussion of some of these papers Last year we stayed until after midnight and it is only ten o'clock now. All of you who go to theatres—and you all go—do not leave the theatre until after eleven o'clock at night, and the theatres come along every little while, but this comes only once a year. Now, I am sure there are some who want to speak briefly.

I want to correct one omission of my own. In looking for institute workers I scarcely know any better place to look in the future than among the graduates of our agricultural colleges in different states, who have formed in Ohio a Students' Union for actual experimentation on their own farms, and who have enough experience on their farms to add to their knowledge. I am sure that Professor Hamilton, merely by oversight, neglected to notice the excellent material that can be furnished from our agricultural colleges, not only from their professors, but from their alumni who have gone into the actual work of farming.

PROFESSOR HAMILTON: Mr. Chairman: It was not an oversight at all; it was an intentional omission. My subject was The Relation of the Farmers' Institute Lecturer to Experiment Station Work. I would like very much some time to discuss the Relation of Farmers' Institutes to Agricultural Colleges, but as that was not my topic tonight I tried to confine myself strictly to my subject.

DOCTOR CHAMBERLAIN: Mr. Chairman, I thought of that while he was speaking, and then I forget it when I made the criticism, but I want to say that that is a most excellent source of material.

PROFESSOR JOHN W. DECKER: It has been suggested by Doctor Chamberlain that the force of the University ought to go out. My schedule for the next winter term will be six half-day laboratory periods and seven lectures, besides the correspondence and other things that will take up my time, and I don't see where I will get any time during the winter term to get out to farmers' institutes; but it has occurred to me that we can do as they did in New York last fall, have a two or three days' session when the farmers' institute workers can come to the agricultural college, and we can present to them certain facts that ought to be presented to the people of the state; we can take them into our laboratories and present different things which they ought to know, which ought to be common knowledge throughout the state, and in that way we can do our part in this larger work. I am sure if it is desired by the institute workers that this be done we would be willing to throw open our class rooms and our laboratories for such a session.

CHAIRMAN THORNE: I think Professor Decker has made a most excellent suggestion. More and more the institute worker must be the mouthpiece of the College of Agriculture and the Experiment Station, and I believe that is one of the things that we need to look forward to and need to plan for, that we more frequently get together here and there, compare notes, and inform ourselves as to the work to be done.

DOCTOR CHAMBERLAIN: Mr. Chairman, you will remember that I recognize most fully the inability of both the Station and the University to send out their staff, and their faculties, in the work, with the existing pressure upon them, and I suggested that it was an excellent field for the state to increase its resources so that with the proper assistance in their work at home they could send forth and diffuse that knowledge through the institutes, and I do not know a better medium of diffusing this knowledge than the living voice of the living speaker, speaking right into the minds and attracting the eyes of the living hearer. There is nothing equal to it; let the state enlarge and give such assistance that these workers can go forth.

SECRETARY W. W. MILLER: The practice of lecturers from the Agricultural College and from the Experiment Station going into the field has been discontinued in Ohio for very good and sufficient reasons. The work of the Agricultural Experiment Station has increased, the attendance of the pupils at the Agricultural College has increased so that the Station staff and professors find it impossible to fill engagements as the State Board of Agriculture must have engagements filled. We have our routes; we have our assignments, not less than a week, preferably for several weeks; and ten years ago we had professors in the Agricultural College and members of the Station staff who were willing to give four or five weeks to the work. That gradually and by degrees was reduced to two weeks, then to a week, and then the professors or members of the staff who would be assigned to duty in the institute field sometimes found it necessary to disappoint the institutes which they were to visit.

Doctor Chamberlain repeated a private conversation in which I was quoted as saying that farmers' institute societies really preferred farmers as lecturers. That is true. I don't proclaim it on the housetops—there are a good many things I don't talk about; this is one of them—but it is true, since it has been brought out here, that the average farmers' institute wants to know that the lecturer is a farmer, and an actual every day farmer, and in the language of Dr. Chamberlain, that he has demonstrated the facts which he gives to the public. That is true. There is no disposition on the part of the College of Agriculture or of the

Experiment Station to shirk any duty, but conditions are such that they cannot give this particular work their best attention, and they have said, individually, to me that it seemed almost impossible for them to fill institute engagements. These are some of the reasons why the Station staff and professors are not on our program; their hearts and sympathy are in the work.

What do I hope for these meetings, of which this is the second? We have many of our institute lecturers here, and I want to say that they are a wonderfully bright set of men and do most excellent work and I am saying this with no idea of flattering them; but it is a fact.

Our work is growing in scope and appreciation, to the entire satisfaction of the State Board of Agriculture. We would like to do better; we think we are doing well, and we have some most excellent men; they are students; they are careful; they are conservative, and they are doing good work; and they are benefitting themselves by coming to the Experiment Station every year, and reading the publications of the Experiment Station between their visits here, and are becoming better qualified to address the institutes to which they are assigned,

We hope in the very near future to adopt the policy adopted in New York and across the lakes in Ontario, of having farmers' institute normals—a normal for farmers' institute lecturers. We hoped to do it last year; we have been hoping to have Director Thorne, Professor Price, Doctor Chamberlain and a good many other well qualified people with us and with our institute lecturers, to hold up their hands and strengthen them in their work, and by doing this we hope to inaugurate a very satisfactory and happy co-operation by the College of Agriculture, the Experiment Station and the State Board of Agriculture in the institute work of Ohio.

CHAIRMAN THORNE: We have with us one who has spent many years in work for agriculture in many of its varied lines. We want to hear from Father Ellis.

MR. S. H. ELLIS: Mr. President and Ladies and Gentlemen: Those of you who were here last year remember that I was on the program and Doctor Chamberlain said that our meeting continued until after midnight—and I was the last speaker on the program; there was no other man here who could have held the audience.

Those of you who were present remember that I made or tried to make three points. I had withdrawn from the institute work—and Secretary Miller will fully corroborate what I told you that I wasn't dropped; I consistently withdrew.

As I said, I tried to make three points. I told you that I had three lines, three subjects, that I had been discussing over the state; that I had flattered myself that I had been able to accomplish a great deal of good in them, and I wanted those three subjects well discussed. One was the importance of the work of the State Board of Agriculture. Let the institute speakers be thoroughly informed as to what the State Board of Agriculture is doing, not only in the institute line but in its general scope. I know all about the State Board of Agriculture, and have at least one lecture that would be full of study thoughts for every community which would hear it.

Another point was the Agricultural Experiment Station, its possibilities, the plant that we have, the outlook, what it is doing, what it can do, what it proposes to do, and to impress that upon the farmers of the state.

The other point was the Agricultural College of the Ohio State University, its wonderful possibilities and capabilities. Since leaving home I was talking with one intelligent gentleman who is present tonight. We were speaking of the Agricultural College, and he said it was the duty of the Agricultural College to carry on original investigation. We were not discussing that line exactly—it was another line—but I made no reply to that as the gentleman will

remember. The gentleman is an intelligent gentleman, he knows what he is talking about, but he got things a little bit mixed. The duty of a college is to teach what is known—to *teach*. The duty of an experiment station is to *investigate* and put the facts of science in shape so that the college professor can teach it to his students, and demonstrate it—have six or eight hundred students there, with a great big blackboard in the shape of a model farm on which to demonstrate the problems they study in the class room.

The speakers ought to be well informed, and it won't hurt any and every one of you institute workers to have a lecture on each of these three subjects. Thoroughly post yourselves on the State Board of Agriculture, what it can do; what it is doing; see that it is composed of solid, good men all the time; every time there is an election see that the right man gets it. We have been wonderfully fortunate in that.

By request, I just want to refer to one problem, and ask for an explanation. One of the speakers said tonight, if I remember correctly, that in order for the teacher in the institute to be fully equipped he should not engage in physical or manual labor; he could not carry on his farm work through the summer and then be fully equipped to go out and teach in the winter. Did not some one say something of the kind, Director Thorne? It has been emphasized tonight—Brother Miller made it very emphatic awhile ago, and even Director Thorne turned a little red—that the farmer who is here, and who came right here from the farm, who has worked all summer and who goes out in the winter to tell what is done, how he raised that big crop of potatoes and what he got for it; how he raised that big crop of apples, how he thinned that out, and how he put them on cushioned benches to sort them out and make them just right, is the one they want to hear. Now, if he did not work in the summer, how could he tell about that?

MR. RATHBUN: All right, when you are through I will answer.

MR. ELLIS: I am glad I am here with you. I have been more or less intimately connected with this work ever since it began—the Agricultural Experiment Station—was at its "borning". The first winter the Agricultural College ran, if I remember correctly, I waded up there through the wet to see how they were getting along and I have watched it closely ever since; served nine years on the board of trustees, and it survived it!

I have been deeply interested in it and I tell you as I have had these years of observation I become more and more enthused with the grand opportunities of the young man and young woman and the man or woman in their prime, in this year of our Lord, 1904, the opportunity that opens out to them to do grand work for humanity in the line of agriculture and work—in every line of honest, industrious, persevering work; it is better than it was before; we are just beginning to learn the great lessons; what we do not yet know would make a tremendously big book. I thank you.

MR. RATHBUN: Mr. Chairman, it may have been my fault in not being able to make myself clear, hence the criticism Brother Ellis made.

If you will remember I said the institute lecturer should have as much practical experience as possible, but if he thought he could teach and do all of the labor of a regular farm hand on the farm he must soon see his error. The fact is that a regular hand on a farm—as I have put in years of my life, put in sixteen hours a day for day after day, until it ran not only into weeks but months—is not able to perform that physical labor, and at the same time improve his mental faculties. I had to stop part of that physical labor before I could get the information into my brain to talk to an audience. Any other man will find that that is true if he has an opportunity to follow it up. Let him have the practical experience; let him work on the farm; let him do the work of a laborer sixteen hours a day, sixteen hours of physical labor, and then put in enough time to

sharpen his wits; enough to keep up ahead of the American farmer of today, and I don't believe he will have made a success. He wants the practical work but there is such a thing as doing too much practical work, too much physical labor to accomplish anything mentally; that is the point that I wanted to make—that he must put in part of his time in mental labor. He may be an overseer; he may be a director; he may direct all the labor on the farm; he may keep all the accounts; he may know all about every crop put in, all the details, but he can not do all the work himself and do that.

DOCTOR CHAMBERLAIN: Mr. Chairman, I move that the amendment be adopted.

CHAIRMAN THORNE: We have a house full of men who are accustomed to speaking, who are full of talk, and we hope to hear from any one who has any further suggestions to offer.

If no one has anything further to say we will stand adjourned.

And thereupon an adjournment was taken until 9:30 a. m. the following day.

Friday Morning Session, June 17, 1904.

The reunion was called to order at 10:00 by Chairman Thorne, who said:

LADIES AND GENTLEMEN: It gives me great pleasure to introduce to you Doctor C. G. Hopkins, of the University of Illinois and the Illinois Experiment Station, a gentleman who has given great attention to the study of the problems of the soil, and who will talk to us this morning on "Balanced Rations for Plants."

BALANCED RATIONS FOR PLANTS.

BY PROF. CYRIL G. HOPKINS.

MR. CHAIRMAN, LADIES AND GENTLEMEN: When Director Thorne asked me to come over here and speak on this question it seemed to be an illustration of "Carrying coal to New Castle," because I understand something of Director Thorne's work in Ohio, and I am pleased to say to this audience that I have gotten more information of value to Illinois from the study of soil work that has been done in Ohio, than I have from that of any other state.

I think if there is any one thing that we know in Illinois, it is that there are differences in soil. We have soils that are highly productive, and soils that are very low in productive capacity. That is stock information among people who have had anything to do with soils, and one of the great problems is to find out what kind of treatment is required for this soil and that soil in order to give plants a balanced ration, because it is just as necessary for plants to have a balanced ration to live upon as it is for animals; for with an abundance of carbo-hydrates, as we have in most places in the stock feeding sections in the northern part of the United States, you know that the stock feeder must figure on balancing that ration with nitrogenous products, such as clover hay, and in addition to all that he uses bran, and cotton seed and oil meal to balance up with the corn, to produce greater gains than he could possibly produce if he did not use some of these concentrated nitrogenous products. If you go into the southern part of the United States you have just exactly the opposite problem. There they have less corn and less timothy hay; they have more cow peas as part of their crop grown in rotation with cotton. Cotton makes practically no part except the cotton seed meal which they have in abundance. You can see that their principal feed is cow peas or beans—both legumes—and cotton seed meal, and these are all nitrogenous, and the problem is to get in the carbo-hydrates and material of that sort, and that is what they buy to balance their rations, while we buy just the other things, so that we can naturally exchange with the south, corn for cotton seed meal to balance.

It is certainly just as important that we have balanced food for plants, for plants require certain elements of plant food to live upon, and without them it is impossible to make plants grow.

In our elementary instructional work in the College of Agriculture in Illinois, our students try to grow plants without any nitrogen, and they make no growth; the seeds germinate but that is all, and then they put in nitrogen and leave out the phosphorus and they get the same results; they make no growth; they leave out the potassium and they get no results; and they leave out calcium, magnesium and iron, and they obtain no crop, for those elements are also essential. It is found that practically all soils contain an abundance of all the elements except the three, nitrogen, phosphorus and potassium, and in the earlier days some people jumped to the conclusion that if any element were lacking they were all lacking, and so it happens that probably eighty or ninety per cent. of all the plant food that is supplied in any artificial form is put in what they call complete fertilizers, such as the 2—8—2 goods containing the equivalent of 2 per cent. of ammonia, 8 per cent. phosphoric acid, and 2 per cent. potash, thus supplying about 1⅔ per cent. nitrogen, 3½ per cent. phosphorus and 1⅔ per cent. of potassium. We should not buy complete fertilizers unless we need complete fertilizers, but we should plan to balance the plant food that we have in our soil. Naturally some soils contain an abundance of nitrogen, if not we should get more from the air by growing more clover or other legumes. Certainly we should not buy that element for use in general farming; if the soil contains an abundance of phosphorus we do not need to buy that and if it contains an abundance of potassium we do not need to purchase that element.

TABLE I.—PLANT FOOD IN SOME ILLINOIS SURFACE SOILS.

(Pounds per acre.)

Elements of plant food	Black prairie (Wisconsin Glaciation)	"Red Clay" hills (unglaciated)	Gray prairie (Lower Illinois Glaciation)	Peaty swamps (Recently drained)
Nitrogen	6,200	1,000	2 800	67,000
Phosphorus	1,600	1,000	600	2,000
Potassium	8,800	5 600	4,200	1,200

CROP YIELDS IN SOIL EXPERIMENTS.

Plant food applied	Corn bushels	Wheat grams	Wheat grams	Corn bus.	Corn fodder lbs.
None	*75	3	10	0	1,000
Nitrogen	....	26	9	0	1,200
Phosphorus	....	3	14	0	2,000
Potassium	....	3	10	36	3,600
Nit., Phos.	....	34	21	0	1,400
Nit., Pot.	....	33	7	40	3,500
Phos , Pot.	....	2	14	38	3,100
Nit., Phos., Pot	....	34	27	60	4,400

*A very common yield. No experiments on this type.

I show you here (referring to chart) four types of soil, each of large area in Illinois. This is just as we find them Here is the best corn soil that we have, right in the belt of black, fertile soil of the Wisconsin glaciation, reaching away down into Illinois. We have there sixty-two hundred pounds of nitrogen in the plowed soil to a depth of seven inches—that quantity of nitrogen per acre. If we remember that it takes one hundred and forty-eight pounds of nitrogen to grow a hundred bushel crop of corn, you will notice that on that basis there is only nitrogen enough there for forty crops—for forty hundred-bushel crops. That is all there is in the richest soil—taking off, not twenty bushels to the acre, not twenty-five, not thirty, but taking off one hundred bushels of corn to the acre. And that is what we do do on our best soils in a good corn year. You can find in almost any community in the corn belt of Illinois men who have soils—not one hundred and sixty acres, perhaps, but small areas at least—where they take off one hundred bushels to the acre. The question is why do they not obtain as large yields on all their corn fields.

I think of about six different factors which have to do with crop production. Some of these factors can be controlled and some can not.

One of them is the seed. You might say the first factor in growing crops is the seed. Now, you know you can do a good deal with seed; you have good seeds and poor seeds; you have distinct varieties of seed, seeds which are capable of making a very much larger yield than others. We have corn which is adapted to this type of soil, and corn adapted to another type. We recognize that the seed is one very important factor, and we have tried to do a good deal with the subject of seed in Illinois; we have tried to improve the seed, particularly our seed corn.

Another factor is what I would call the home for the plant. Plants must have a place to live, independent of everything else; they must have a place which they occupy, and of course that is the soil. That soil may have plant food in it or it may not, but the plant must have a home. Whether the soil is a good home for the plant depends upon whether it is loose and porous and well kept, upon whether it makes a good, deep place for the roots. If the physics of the soil is good, then it is loose, porous and absorbs moisture, and there is plenty of organic matter in it and its drainage is good and it doesn't contain too much water. Such a soil we say is a good home for the corn plant.

We have other factors over which we do not have very much control. The moisture question is a factor, independent of plant food. We must have moisture. It is said, from investigations carried on by Professor King, and a good many others, that the average amount of moisture required to make a pound of dry matter in plants is about three hundred pounds. Of course that does not refer to plant food, but a large amount of moisture is an absolutely essential factor, and is required to carry on the circulation of plant food, and possibly for evaporation to keep the plants cool, just the same as we evaporate water from our bodies to keep ourselves cool. If the corn plant during the hot summer has plenty of water to bring up and evaporate, it keeps itself cool; if it does not have a sufficient supply, very frequently it burns or "fires" in the sunshine. We can control the moisture to quite an extent.

The question of heat is still a different factor. If the temperature is low and cold we can not get a good growth because the fixation of carbon from the air, by the sun's energy, is dependent upon the heat, so when we have just the right temperature our corn grows with very much greater rapidity than it does when the temperature is low.

Light is a factor, independent of these others. We must have light. In fixation of carbon, corn does not grow as rapidly on cloudy days, even if the temperature is the same, as it does on light, bright days. That is a factor over which

we have but very little control; possibly we can control it somewhat by drilling our rows of wheat or oats north and south. Some say you can thus get a better catch of clover, as it lets the light in a little better than the other way. We can put the plant in the dark where it cannot get any light, and the fixation of carbon stops. It might put out stems longer, but there is no increase in weight. The increase in weight stops as soon as you take the light away.

There is another factor which I wish to speak of particularly this morning, and that is the plant food. Plant food is an absolutely different factor from any of these others. It is not the seed; it is not the home of the plant. You may have a fine home for a plant, fine soil, but no plant food. And it is not the moisture; it is not the heat, or the light, but it is simply a question of feeding the plant with food, and that is what these figures represent here (referring to chart.) This is the food that the soil can furnish. The quantity of food is limited in our soils, the same as food is limited for animals—so limited that we can make some computation. Whenever the other factors are all right—plenty of heat and light and a good physical condition, and plenty of moisture—then we can grow one hundred bushels of corn all through this country if we have plant food enough to do it.

Sometimes one of these factors limits the yield, and sometimes the other, but the evidence is that plant food is very commonly the limiting factor in crop production.

Here is the quantity of nitrogen we find in another soil. We have about seven counties in the extreme southern part of Illinois where the principal type of soil averages not above a thousand pounds of nitrogen per acre in the plowed soil, and there is a much smaller percentage of nitrogen below the plowed soil. Nitrogen is always associated with the humus or organic matter, and if we have almost no humus we have but very little nitrogen. You will see that if this soil could grow forty crops of corn this one could grow only seven, even if you could get all the nitrogen out of the soil, which, of course you can not do; consequently the result is that this has so little nitrogen that you can not get enough to make a good crop.

Here is the average soil of about twenty-five counties, of what we call the lower Illinoisan glaciation, in the southern part of the state. Here we have twenty-eight hundred pounds of nitrogen per acre.

Here, again, is a soil that represents hundreds of thousands of acres in the northern part of the state. We call this peaty soil, and here we have sixty-seven thousand pounds of nitrogen to the acre. We have all the way from one thousand pounds to sixty-seven thousand pounds of nitrogen in these different types of Illinois soil. These are not to be considered little patches; they represent immense areas. This morning as I was waiting up at Lodi I began to look around and discovered that I was right in the midst of a peaty swamp and I went out and gathered up a little of the peaty soil. There are apparently thousands of acres of it right here in Ohio. You can see what it looks like. Just pass that around (handing dish containing soil mentioned). The soil will burn no doubt, and this would probably approximate the composition of our Illinois peaty soils. This soil contains immense quantities of nitrogen and phosphorus but it is deficient in potassium. Now, to make such a crop of corn as we want to grow, and as we find it is possible to grow, takes twenty-three pounds of phosphorus out of the soil, and we have only six hundred per acre in one Illinois soil. You can compute that in the plowed soil we have enough phosphorus to make about twenty-seven or twenty-eight large crops, if we took everything out of the plowed soil down to a depth of seven inches, and the soil below that is poorer than the top soil—not so rich in phosphorus. And there is a limit to the

depth from which plants can draw plant food. On the other hand here is a soil in which we have two thousand pounds of phosphorus per acre. Now in that soil there (pointing) we have eight thousand eight hundred pounds of potassium, and this soil contains only twelve hundred pounds of potassium per acre to a depth of seven inches.

It takes seventy one pounds of potassium to make a hundred bushel crop of corn, and if we divide this twelve hundred by seventy-one we see that about sixteen crops of corn would take all the potassium out that there is in that soil.

It is the maximum crop of corn, or any kind of crop which makes the profit to the farmer. You know there is no profit in raising forty bushels of corn to the acre; there is just simply no profit in it if a man can not raise more than forty bushels to the acre on land worth one hundred fifty dollars an acre. Figuring the interest on the money, and the actual expenses of raising the crop, you will find by computation on forty bushels there is no profit in it. We must go above that. Well, now then, stop and think; if you grow fifty bushels you have about ten bushels profit; if you grow seventy bushels you have increased your profit three times, and that is where the profit is—in changing not from twenty to thirty or from twenty to forty—there is no profit in that—but in changing from sixty to eighty; that twenty bushels is practically all clear profit. You may have to pay two cents a bushels extra for husking, perhaps, that is all. Otherwise the expense is the same whether your yield is 60 bushels or 80 bushels.

Now, I want you to notice some of the results we have gotten in actual experiments on these different kinds of soils in Illinois. We have been trying to balance these soils, trying to see what is needed to balance the plant food already in the soil.

There is a soil which we find is only moderately well supplied with phosphorus, while it contains about twice as much potassium as a normal soil needs, but you will notice it contains only one-sixth as much nitrogen as it ought; on that basis it needs more nitrogen first of all to make good crops.

Here we have put on no plant food and we have grown wheat and we have gotten three grams of wheat in pot culture. Here we put on nitrogen and we got twenty-six grams of wheat—just by adding that single element. We put on phosphorus and we got three grams, which is the same as with nothing; we added potassium and we got three grams. Now, after adding nitrogen on this pot here, you see we have added phosphorus also and we then obtained thirty-four grams of wheat.

It is an interesting thing that we have taken that soil in pot culture work and we have grown legume crops and turned them under and gotten our nitrogen from the air by that method, by the bacteria which lived on the roots, and we have then gotten better results with succeeding wheat crops than where we bought our nitrogen and put it on, showing that we get plenty of phosphorus and potassium from the soil when we do that, because we let that organic matter rot in the soil. You know the effect of decaying organic matter, how active it is. For example, you put a pitchfork in a pile of manure and let it stand there for three months when the manure is rotting, and then go and examine it and if there are any tines left, you can probably break them with your fingers; they will have rusted through. With decaying manure or clover residues the soil decays or decomposes, and if you have plenty of phosphorus or potassium in it you can make it soluble or available in that way. I want to say that this is the principle which we are working on in Illinois. Wherever we have plenty of plant food in the soil, we want to get it out in growing crops. Where we have enough phosphorus or potassium already in the soil, or where, as is common

in Illinois, we find the potassium away above normal—above what there is ordinarily in good soils, we do not think we ought to buy potassium to apply to that soil, but we think it is the business of the farmer to liberate the potassium from the soil and we can do that easily with decaying organic matter.

In this pot we have added both phosphorus and potassium to that soil, and we have two grams, which is a little less than with nothing. When we added all plant food, that is we put in the nitrogen with the phosphorus and potassium, we have thirty four grams, I don't think we need anything more striking regarding the importance of balancing the food of plants than we have here. The nitrogen is the element that is needed. This effect can be had by putting in a legume crop instead of buying commercial nitrogen. After nitrogen we can add a little more phosphorus because that is not a rich soil in phosphorus.

Now, here is another type of soil that we worked upon. You will find, by comparing this with what we might call a standard soil, containing six thousand pounds of nitrogen, two thousand pounds of phosphorus and four thousand pounds of potassium, that we have in this soil only half enough nitrogen and less than one-third enough phosphorus. Therefore, phosphorus is the limiting element. We begin to add plant food. To this pot we add no plant food and we get ten grams of wheat; we put in nitrogen and we get nine grams, actually a little less growth than we get without anything, and t' . is explained by the fact that this element is not yet needed. That soil does ot need any nitrogen while the phosphorus remains so low; it can't use it; it already has a better supply of nitrogen than phosphorus, measured by the relative amounts required by plants, and you would not expect additional nitrogen to be of benefit. It is just like feeding cattle a little too much oil meal. Suppose you are already feeding them as much as they can use, so that they do their best and you are giving all the oil meal they will stand; and now just double that oil meal in the ration, and Mr. Bradfute and other stock feeders know about what the result would be; they would do decidedly poorer; they would not make the gains that they would make if you had not increased the oil meal. You can have too much of a good thing. We have already in this soil all the nitrogen that the crop can take in proportion to phosphorus that it has. The limiting element is not nitrogen but it is phosphorus and to increase the yield at all we must add phosphorus. If we put in plenty of phosphorus then we can use more nitrogen, and then when we add the nitrogen it may increase the growth. We have added phosphorus and get a gain from ten to fourteen. One might ask why doesn't that go away up to twenty-six; on the other type of soil we increased the yield by a single element from three to twenty-six grams; and here we have only increased from ten to fourteen? But when we get to fourteen by means of phosphorus, then nitrogen limits the yield.

We may say the soil contains enough phosphorus to make ten grams; it will furnish enough nitrogen to make only fourteen, so when we add phosphorus we can get fourteen, but you can not get more than fourteen unless you add nitrogen, too. Here we have added phosphorus with potassium and it went up to fourteen. These results are almost as much in accord with each other as we get in analytical chemistry; they follow out the actual indications of the analyses about as closely as we can make the determinations themselves. We add phosphorus, the most limiting element, and that carries it to fourteen. We add nitrogen after that, which is the next element needed, and it carries it to twenty-one. You will notice that potassium is the last element, and that is what we call a normal soil. It is up to normal in potassium, but there we do not have the gains we ought to have gained. The soil needs organic matter to liberate potassium from the soil. So, as a matter of fact, if we add potassium we get a still greater increase, and it goes up to twenty-seven—from twenty-one to twenty-seven by adding potassium.

We have now over twenty soil experiment fields in Illinois where we have experiments going in all sections of the state, from the north to the south and the east to the west, on these different types of soil. Last year where we had tile drained this same soil and got the water out so that the roots could go down deeper where there is plenty of potassium—lots of it in the subsoil—and turned under legume crops, then we did not get any marked increase by adding potassium after that. Where we added phosphorus and furnished the nitrogen with legumes we obtained an increase of yield, and this year we have just the same results. This year we have wheat on untreated plots on this type of soil which will probably make ten bushels to the acre. It is a pretty good wheat year with us and the wheat will probably make ten bushels.

Our state advisory committee, consisting of five practical farmers, estimate that where we have tile drained the land and turned under legume crops and then added that one element, phosphorus, the element that is most needed, it would make forty bushels to the acre right on the field, and when we put potassium with it it did not help it at all—at least we couldn't decide that it would; we simply said it would take the scales to determine whether potassium made any gain on tile drained land, although it did increase the yield on undrained land.

Here is still another type of soil. We know what that soil contains. This particular area contains about five times as much nitrogen as a good rich soil; and here are two thousand pounds of phosphorus. That is what we call normal, but there are only twelve hundred pounds of potassium, while here in these other soils we have eighty-eight hundred, and fifty-six hundred and forty-two hundred pounds, respectively, of the element potassium. Now, here are the results in crop yields that we have gotten upon this kind of soil. That is a soil that will not grow corn for more than four or five years. After that it won't produce anything but a few stalks. Here we put on nothing. It won't even make nubbins. It made a thousand pounds of what you may call fodder, and we added nitrogen to the soil and we got twelve hundred pounds of fodder, but no ears. We put on phosphorus and we have a ton to the acre of fodder, but no ears yet. Now, we add potassium and we get thirty-six bushels, and I want to say it was a very wet season, or we would have gotten more. There were one or two places, somewhat higher land, about a foot higher, so that the water did not injure it so much. Now, balance the food with potassium right between those two, and it yields thirty-six to forty bushels of corn, while on this plot we did not get an ear of corn, although we had applied both nitrogen and phosphorus; but here where we put on potassium with the nitrogen we got forty; and here potassium again with phosphorus we got thirty-eight, and here we put on potassium with nitrogen and phosphorus and we got sixty bushels—but the difference is not due to elements added other than potassium. It was slightly higher land so that it was not damaged quite so much by water. All the potassium plots should have made sixty bushels.

QUESTION: You think, then, the chemical analysis of the soil does help the farmer in telling what he should use as a fertilizer on that soil?

PROFESSOR HOPKINS: I would not say that you can take a soil and analyze it and then know just what to put on that soil for that crop, because you have in this question the physical condition of the soil; you have got the matter of decaying humus, and all those things to consider.

The chemical analysis will tell you what sort of a system you must adopt in order to maintain the fertility of that soil; it will tell you whether you have got plenty of plant food in the soil—whether your duty is to get it out, or whether you have but little plant food and your duty is to add more.

THE QUESTIONER: You frequently hear it said that a chemical analysis is not of any very great value to the farmer in determining these matters but the chart seems to indicate that in that soil it did furnish the basis for very great work?

PROFESSOR HOPKINS: Well, I think it is altogether wrong to say that it is not of great value. I think the chemical analysis is of very great value in determining how we should farm, but on the other hand many people have said that they have studied the chemical analysis and it is of very little value because it won't tell us absolutely everything we want to know about the soil.

DOCTOR CHAMBERLAIN: May we not say that it is of very great importance to the man who understands the combination ?

PROFESSOR HOPKINS: Yes sir, if some of you find that your soil contains much nitrogen and phosphorus but very little potassium then it is a very good thing as an indication that potassium is what you should try. If you can get the potassium out of the soil, instead of putting more on, then adopt the system of liberating it.

QUESTION: I get it from the chart that the chemical analysis is of more value to one who understands how to use it than to one who does not?

PROFESSOR HOPKINS Yes, and I think the chemical analysis is of very much more value to the person who owns the land than to the man who has a one-year's lease on it and does not expect to farm it after that year.

TABLE 2—FERTILIZERS FOR CROPS GROWN IN FIVE-YEAR ROTATION IN OHIO.

Soil plot No.	Plant food applied	Cost of plant food in 5 years	Wooster field		Strongsville field	
			Value of increase	Profit (+) or loss (—)	Value of increase	Profit (+) or loss (—)
5	Nitrogen	$12.00	$ 5.64	—$ 6 36	$ 0.57	—$11.43
2	Phosphorus	2 40	11.40	+ 9 00	14.56	+ 12.16
3	Potassium	6.30	4.44	— 2.06	0 53	— 5.97
6	Nitrogen, Phosphorus	14 40	22 05	+ 7.65	16.76	+ 2.36
9	Nitrogen, Potash	18.50	6.24	— 12.26	2.50	— 16.00
8	Phosphorus, Potash	8.90	16.57	+ 7.67	14.35	+ 5.45
11	Nitrogen, Phosphorus, Potash.	20 90	27.83	+ 6 93	19.98	— 0 92
12	Nitrogen, Phosphorus, Potash.	26.90	28.97	+ 2.07	20.33	— 6.57
14	Nitrogen, Phosphorus, Potash..	14 30	22.70	+ 8.40	17 02	+ 2.72
15	Nitrogen, Phosphorus, Potash..	7.70	15.57	+ 7.87	10.22	+ 2.52

I do not mean to take but a moment's time with this chart, giving results of Ohio experiments, because I assume Ohio people are familiar with these results. As I said we get very valuable information from the work that has been done here. I just want to show this as bearing upon this question of balancing the soil.

Here is the profit which has been made as an average of ten years from the addition of nitrogen alone; that is, it lacks $6.36 of paying for itself where nitrogen was bought and put on. Where they put on phosphorus alone it paid $9.00 profit; with potassium alone there is $2.06 loss; with both nitrogen and phosphorus there is $7.65 profit. People sometimes make the mistake right there;

they buy nitrogen and apply it to the soil with phosphorus, and they say it is a good fertilizer, and they keep on doing it sometimes, but you will observe that the phosphorus alone made $9.00 and when you bought both together the phosphorus made all the profit and paid for the loss on the other.

Even though you do make a profit with a mixed or complete fertilizer it does not necessarily follow that you are doing the most profitable thing; if you would leave off the nitrogen your profit would be larger. You can run down that whole column and there is not another figure that makes a profit of nine dollars. It is true that we have a good many combinations that make a profit. Nitrogen, phosphorus and potassium make a profit of $6.93, but that is not good enough when you can leave out the nitrogen and potassium and then make $9.00. At Strongsville the results are even more striking. We have with nitrogen a loss of $11.43; with phosphorous a gain of $12.16, and with potassium a loss of $5.97. And wherever you have added all three elements your gain is low and you have lost ten dollars. The phosphorus could scarcely pay for all the loss due to nitrogen and potassium even with the great profit you get from the use of phosphorus. These two elements, nitrogen and potassium, give you a loss of $16.00. Here with phosphorus and potassium you have a gain of $5.45, but you see you have taken about $7.00 of the profit from phosphorus to pay for the loss from potassium, and with the large increase that you do get from your phosphorus, it is not equal to the loss on the other two elements, so that your net result is 92 cents loss, when all three elements are added.

QUESTION: How about the chemical analysis of this soil?

PROFESSOR HOPKINS: The analysis of the soil at Strongsville shows that it contains as much, or a little more, potassium, I think about twenty per cent. more potassium, and nearly double the nitrogen and somewhat more phosphorus than you find at Wooster. The nitrogen and potassium increase more rapidly at Strongsville—that is you have a larger supply in proportion at Strongsville than you have at Wooster. There is also somewhat more phosphorus there, but decidedly more nitrogen and potassium.

QUESTION: My understanding was that at Wooster it was greatly deficient in nitrogen?

PROFESSOR HOPKINS: Yes, it is.

THE QUESTIONER: And the nitrogen loses money at Wooster?

PROFESSOR HOPKINS: Yes, but it doesn't lose so much as it does at Strongsville; the nitrogen makes greater gains at Wooster, but it does not make any actual net profit, although it increases the yield—not enough to pay for itself—but more markedly than at Strongsville. It is a rather peculiar thing at first to notice that phosphorus applied to the Strongsville soil makes greater gains than it does here at Wooster, and it does the same thing in Illinois.

Our soils are rich in potassium and rich in nitrogen, but not well supplied with phosphorus; phosphorus is the limiting element on many of our soils. You have nitrogen enough to make sixty or eighty bushels to the acre at Strongsville; you haven't enough here to make more than forty, perhaps; you have potassium enough to make one hundred and fifty bushels to the acre at Strongsville, and the one thing you lack over there is the phosphorus to make your yield go away up, while here, when you add the phosphorus, the yield only goes up a little ways, until the nitrogen holds it down, and you do not get the profit out of the phosphorus which you would if there were more nitrogen. Is that plain?

And so our people in Illinois think that way. Our soil grows sixty bushels to the acre, and some might say why do we need to add any plant food? Why just because the sixty bushels to the acre is the best they can get with the phosphorus contained in the soil, while they have nitrogen enough and potassium enough to make one hundred bushels, and you see there are forty bushels more

they might get, and we expect we will get that forty bushels with phosphorus, always keeping up our nitrogen with clover and other legumes. The second year after we began our experiments—this last year, 1903—we increased the yield as much as twenty-two bushels to the acre with phosphorus alone—we increased it from fifty-nine to eighty-one.

DOCTOR CHAMBERLAIN: The skeptic, I think, would call attention to the first column of figures there. You say you put on $12.00 worth of nitrogen and lost; you put on $2.40 for phosphorus and gained, and with the potash you put on $6.50 and lost; and nitrogen and phosphoric acid you put on $14 40. The skeptic would say, does it make any difference whether they put an equal value of nitrogen—equal to the value of phosphorus? If not isn't it possible that the nitrogen applied in smaller quantities might prove a less disastrous financial loss?

PROFESSOR HOPKINS: Yes, Director Thorne has done that; he has put on less and less nitrogen and he has found the greatest profit when he does not put any on.

DOCTOR CHAMBERLAIN: That is the point which was in my mind.

PROFESSOR HOPKINS: Yes, that is the average yield for the ten years. I believe the average for the last five years is not quite so bad. Nitrogen shows more effect. That means to him that he will grow more legumes in his crop rotation—not that he should buy any nitrogen. I admit that there may be conditions when you could buy nitrogen and, perhaps, make a dollar in five years, but you could as well make fifteen dollars if you used legumes instead of commercial nitrogen, for the farmer can get nitrogen from the air for one cent a pound while it costs about fifteen cents in commercial fertilizers.

But, on the other hand, there is a point that should be explained. It is exceedingly fortunate that you can put on lots of phosphorus without very much money, especially the lower grade. You will remember that a hundred bushel crop of corn takes off one hundred and forty-eight pounds of nitrogen and that is worth fifteen cents a pound in the market. Now a hundred bushel crop of corn takes off only about twenty-three pounds of phosphorus, and we can get that for twelve cents a pound—

QUESTION: Doesn't the source of nitrogen have a good deal to do with the profit?

PROFESSOR HOPKINS: Well, it may modify it somewhat but we don't have any very definite information on that. Professor Huston, in Indiana, carried on experiments for four years to determine the best form of nitrogen for wheat, but the results are conflicting. Dried blood is, for some seasons, a very good form, but I think the best form of nitrogen is that which you get in the legume crops. Of course, the truck farmers, who take off two hundred or three hundred dollars from an acre can afford to buy anything in the way of commercial fertilizer, including sodium nitrate or other forms of nitrogen.

QUESTION: In this discussion, Professor, you are using the terms nitrogen, phosphorus and potassium in their chemical signification?.

PROFESSOR HOPKINS: Yes sir; we do that altogether in Illinois; not only in their chemical significance, but also in their agricultural significance. Phosphoric acid, as people speak of it when they are talking about agriculture, is not phosphoric acid but phosphoric oxide, a compound containing about forty-four per cent. of phosphorus and fifty-six per cent. of oxygen.

DOCTOR CHAMBERLAIN: We have been in the habit of saying ammonia for the nitrogen and phosphoric acid or oxide instead of phosphorus. Our phosphoric acid costs us less than five cents.

PROFESSOR HOPKINS: Well, there is two and one-half times as much phosphoric acid as phosphorus; if phosphoric acid is worth five cents, then phosphorus is worth twelve. You buy it for the phosphorus in it, that is all.

DOCTOR CHAMBERLAIN: I know, but it is as phosphoric acid and ammonia, and that is so firmly settled that it is almost impossible to change it in the minds of our people, any more than it is to go to the decimal system of weights and measures. We say pounds and ounces; you know it is pretty badly fixed in Ohio.

PROFESSOR HOPKINS: Yes, I suppose it is the more so the farther east you go, but it is a pretty large question as to what we ought to do; what our duty is in that matter. It should not be at all difficult for us to change to the basis of elements, as it is the simplest basis possible. Our Illinois farmers understand it better than our eastern farmers; that is they go to the bottom of it. I do not think it would be half so hard as when our forefathers changed from shillings and pence to dollars and cents, and the world has followed us in that decimal money system, and I think we ought to bear in mind that the people who are using these terms are perhaps not more than two per cent., if they are two per cent., of the people in the United States.

DOCTOR CHAMBERLAIN: You favor the decimal system of weights and measures?

PROFESSOR HOPKINS: I would have favored it if it could have been adopted at the same stage as we are now in with the plant food question. I think that is one mistake handed down to us. If our forefathers had adopted it when they adopted the decimal money system we would have blessed them for it, but we have gotten so far in the weights and measures that it would be very difficult.

But we are right in the beginning of the plant food question—right in the infancy of it. I do not suppose there are five per cent. of Ohio farmers who understand it. Most of them just buy the "Sure Winner" brand or somebody's "Big 7," because it gave good results last year, and I believe the day is upon us to put that upon a basis where farmers can understand the whole thing.

I might say that in Illinois, The Illinois State Farmers' Institute passed a resolution asking the Illinois legislature to put this thing on the basis of elements so that they could understand it.

Did any of you ever try to explain to the farmer how much potash there is in potassium chloride?

DOCTOR CHAMBERLAIN: Oh, it is a very, very hard question.

PROFESSOR HOPKINS: Have any of you ever tried to explain how much K_2O there is in KCl—how much potash (potassium oxide) there is in potassium chloride, which has no oxygen in it at all? I have labored two hours with a man, a good intelligent man, and when we got through he was just as disgusted with science as a man could well be. He says you scientific people persist in loading that stuff onto us and trying to make us understand, when you admit yourself that what we want is not potash but the element potassium. It follows that there is no potash in potassium chloride; there is potassium in it and that is all we want it for. Then you still say "muriate of potash." Now the ending "ate" throughout the scientific world means oxygen "Muriate" is the name that was used fifty years ago and hasn't been used in real science since. When we go into any other branch of business, any other industry, there we call things by their right names. You go into the iron and steel works and when they say phosphorus they mean phosphorus, and you go into medicine and when they say phosporic acid they mean phosphoric acid. It is only in agriculture that we persist in such confusion of terms

QUESTION: On the other hand the phosphorus that is handled by agriculture is handled as phosphoric oxide or phosphoric acid?

PROFESSOR HOPKINS: Hardly; neither phosphoric oxide nor phosphoric acid exists as such in soils or fertilizers.

QUESTION: Plants all take the phosphorus as an acid?

PROFESSOR HOPKINS: No, they take it better as calcium phosphate; if you put phosphoric acid or phosphoric oxide, either one, on plants, it would kill them.

QUESTION: What is the chemical change of those two?

PROFESSOR HOPKINS: It is taken in the form of a compound of calcium and oxygen and phosphorus.

QUESTION: That is the form we get it in, but all we care for is the phosphorus?

PROFESSOR HOPKINS: Yes, just that element phosphorus. We have the three elements, nitrogen, phosphorus and potassium; that is what we want.

QUESTION: Plants never use phosphorus as phosphorus—pure phosphorus?

PROFESSOR HOPKINS: Not in the free state, neither do they use phosphoric acid or oxide in the free state; we do not care what the form is so that it is a suitable plant food. None of these elements is used in the free state except nitrogen, as it is used by bacteria; nevertheless it is the element which we care for. We can use potassium as potassium chloride, as potassium sulfate, as potassium nitrate or in other compounds, and so with the other elements nitrogen and phosphorus. Half of the states already use the word nitrogen instead of ammonia.

DOCTOR CHAMBERLAIN: But the people now half way understand our nomenclature, and we are afraid if we change they won't understand it at all.

PROFESSOR HOPKINS: Well, I think they would certainly understand it not only half way but the whole way if they would change.

DOCTOR CHAMBERLAIN: I think the best system of weights would be the other, but I am afraid we can't get it.

PROFESSOR HOPKINS: But we are not so far with the plant food business in the United States. I believe, myself, that it is the duty of this country to put our people on the simple basis which they can understand. I think it will be a great thing for the central west if you can simply turn this thing over. I tell you within fifteen or twenty years the amount of phosphorus they use in those little two by four farms along the Atlantic coast won't amount to much as compared with the business to be done in the great Mississippi valley. This is where the United States expects to raise crops.

Of course they can use both terms if they want to; you can publish a bulletin and use both terms as long as necessary. It is only within a short time that the Pharmacoepia and the dispensaries in pharmacy have changed from the old apothecaries' system to the decimal system, and they have changed from saying nitrate of soda to sodium nitrate, they call everything by their proper names now; for about two years they put in both forms.

QUESTION: My understanding in Ohio was that the only mistake we made was in the name; we got the subject all right?

PROFESSOR HOPKINS; That is all.

QUESTION: We call it the wrong name?

PROFESSOR HOPKINS: Yes.

QUESTION: I should like to ask one question, possibly not connected with it. You say the great west is using a large amount of phosphorus. Are they getting that supply from rock sources?

PROFESSOR HOPKINS: Well, you have a pretty large question there, as to the best form to use. I am not altogether sure that the best source that we have now for general use is from the acidulated rock. I do not think we should use the acidulated rock, unless it is absolutely necessary to get it well distribued in the soil, and if we do use that we must correct the acid with lime, but do you know the form of phosphorus that we have in fertile soils is ground rock phos-

phate? it has never been treated with sulfuric acid, but we do give it a mild acid treatment by turning under organic matter and letting it rot in the soil, and turning under clover and manure and stuff of that sort. This makes it available for the plants, and no one has furnished more valuable data along this line than the Ohio Agricultural Experiment Station. If you won't say anything about it to the owners of the great phosphate deposits I will tell you something. I have figured out from the seven years' work that Director Thorne has done, that where he put on the amount of phosphorus—in ground rock phosphate—that we buy in Illinois for sixteen cents, he has made about $1.08—he has made this increase without any sulfuric acid on it. He simply mixed it with ordinary farm manure, and that is the average profit for seven years. But if you will figure it out from the data he has put out you will find that he has made that profit with the very phosphate that we buy in Illinois for seven dollars a ton. That is the price for ground rock phosphate which we pay in Illinois. I get it on my own farm in southern Illinois for eight dollars a ton, while acidulated phosphate or acid phosphate will cost four or five times as much on the basis of the total phosphorus.

QUESTION: Oh, that is acid soil, do you get the same results in an alkaline soil?

PROFESSOR HOPKINS: We get our best results when we use the rock phosphate in connection with decaying organic matter.

QUESTION: Our soil here is acid; the test indicates acid; in case that is so does that account for the result?

PROFESSOR HOPKINS: No, I don't believe that would account for it; I don't believe there is enough acid in the soil to convert the crude rock into acid phosphate; I think it is the decaying organic matter that produces the result. When the manure or clover residue decays it forms organic acids.

DOCTOR CHAMBERLAIN: In large experiments on my own farm the floats did not produce one-quarter as good results as the acid phosphate.

PROFESSOR HOPKINS: How much floats did you put on?

DOCTOR CHAMBERLAIN: Oh, I put on over six hundred pounds to the acre.

PROFESSOR HOPKINS: I am putting on a ton to the acre every five or six years.

DOCTOR CHAMBERLAIN: Well, I remember I put on between six hundred and one thousand pounds.

PROFESSOR HOPKINS: Did you turn it under with clover or mix it with the manure?

DOCTOR CHAMBERLAIN: No.

PROFESSOR HOPKINS; Well, if you put it on poor soil, deficient in humus it gives no results to speak of.

DOCTOR CHAMAERLAIN: Mine was not deficient in humus; clover had been plowed under.

PROFESSOR HOPKINS: Did you apply the acid phosphate on top of the ground?

DOCTOR CHAMBERLAIN: No, in with the potatoes; with the same soil, the acid phosphate paid four times as well.

PROFESSOR HOPKINS: Did you put it on and turn it under where the organic matter was rotting in the soil?

DOCTOR CHAMBERLAIN: Well, it was put down four inches deep; you see in that soil that was very near the rotting matter.

PROFESSOR HOPKINS: That would not be with it. We have gotten the same results in our pot cultures at the University of Illinois. Where we have put on floats on the ordinary soil that had nothing decaying in it, not mixing it with decaying matter, it produced practically no results, no increase whatever, but where we mixed it with the clover or manure and turned it under it has given better results.

I don't mean that we apply equal quantities of untreated rock phosphate and acid phosphate; we put on equal money values. If we put on three hundred pounds of acid phosphate we would put on one thousand pounds of untreated rock, becaus we can get it for the same amount of money.

DOCTOR CHAMBERLAIN: That is what I did; equal in value.

PROFESSOR HOPKINS: Well, as I said before you will probably get little or no benefit unless you get it intimately mixed with decaying organic matter, and even then the acid phosphate may give the best results for the first few years. The acid phosphate is soluble and it has become more thoroughly distributed in the soil.

Now we have to solve this problem: What is the soil going to become eventually? Take even the results we have here from Director Thorne's work. He has tried to supply plant food for the increase in the crops that he takes off and has applied as much or more phosphorus than is needed to keep up that increase, but, as a matter of fact, he hasn't put on phosphorus enough to equal that which has been taken off in the total crop. We ought to figure just as a man does on his income. Some wise man said some time that a man who has an income of a dollar and an outlay of a dollar and ten cents winds up in the poor house—

DOCTOR CHAMBERLAIN: That is Micawber in David Copperfield.

PROFESSOR HOPKINS: But if he has an income of a dollar and an outlay of ninety cents he will become a wealthy man.

I think we have that same problem in soil fertility. If you can add just a little more plant food than the big crops take off you are going to have a rich soil, but if you add less than you take off, or you do not add any—the way many farmers do in our state—your soil is going down.

QUESTION: Where are we going to get the phosphorus to do that?

PROFESSOR HOPKINS: That is why I raised the question of untreated rock phosphate. You know we can put on our soil for eight dollars as much phosphorus, in the form of ground rock phosphate, as there is in a thousand bushels of corn or you can take that ton of rock phosphate, that costs three to four dollars at the mine in Tennessee, and add to it eight or ten dollars worth of sulfuric acid and make two tons of acid phosphate half as rich in phosphorus as the original untreated rock, then ship both tons up into Illinois, where they will cost fifteen to eighteen dollars a ton, or thirty to thirty-six dollars for the two tons, and sometime you will have to buy lime to correct the acid put on the soil in the acid phosphate. Now figure on making your soils richer in phosphorus by using acid phosphate or untreated rock phosphate. With acid phosphate about the best you can do is to supplement what you can get out of the soil. Plan to get out all you can from the soil and then plan to put on a little more; that is what you do when you just put on partly enough to make a crop. You want to take off twenty pound of phosphorus and you add five and take off your twenty, and you get fifteen out of the soil and of course you leave the soil poorer and poorer every year.

QUESTION: Do you think our soil demands to have put back equally as much fertility as we take off?

PROFESSOR HOPKINS: My idea is that our soils should produce in any good wheat year, about forty bushels of wheat per acre, and you ought to produce under fairly good conditions sixty bushels of oats or seventy-five bushels of corn, but you should build up your soil in the element that is most needed. There is no need to apply any element which is already present in abundance.

Probably you have potassium enough in your soils to grow two or three thousand crops of corn. In most of our soils, going down two or three feet from the surface, there is enough potassium to grow an immense number of crops.

You can get all the nitrogen you want. It is just as free as air. The only element we need to figure on for ordinary farming is the element phosphorus. That is the limiting element, and if we can get that in ground rock phosphate at eight dollars a ton and can make that available by putting in organic matter, then I think it is possible to make our soils richer than they ever were.

QUESTION: What is the possibility of going simply a little deeper in our own farms for that phosphorus?

PROFESSOR HOPKINS. Well, we ought to do that as much as we can, but in our soils in Illinois we find there is less phosphorus down there than there is in the top soil, so we cannot expect to draw on it always.

QUESTION: But does not available phosphorus revert when left in the soil?

PROFESSOR HOPKINS: Yes, it reverts to the insoluble form in a few hours.

THE QUESTIONER: I mean insoluble so that it cannot be used by plants, that sort of insolubility; does that occur?

PROFESSOR HOPKINS: No phosphorus becomes absolutely unavailable in the soil, but it goes back to its original form. Remember, the phosphorus naturally in the soil is not acid phosphate and it is made available as plant food.

THE QUESTIONER: I wish you would give an intelligible definition of the two words "insoluble" and "unavailable;" I am a good deal confused as to them?

PROFESSOR HOPKINS: Well, as commonly used, they are supposed to mean the same. Insoluble phosphorus we consider that which is insoluble in ammonium citrate solution of definite strength and that is supposed to approximate the action or power of plants. The phosphorus that does not dissolve with citrate solution is supposed to be unavailable for plants; but if you use more citrate solution or if you use it for a longer time you would get more phosphorus dissolved. There is no acid phosphate in normal soils; it is all insoluble, but if it is finely distributed the plants certainly have power to make it available, especially in the presence of decaying organic matter. The rock phosphate should be as finely ground as possible and just as thoroughly mixed with the soil as possible and with plenty of decaying organic matter.

QUESTION: Have it finely divided?

PROFESSOR HOPKINS: Have it finely divided and thoroughly well distributed.

QUESTION: Have you determined the per cent. of free calcium oxide or calcium in the Tennessee floats, as is being applied in your work—where nitrogen comes in it as calcium phosphate?

PROFESSOR HOPKINS: There is practically no nitrogen in it; and there is no free calcium oxide; there is but little calcium carbonate—not over seven per cent. in any common sort. The question that was raised as to the value of floats as an absorbent for nitrogen, as compared with its value for the phosphorus contained has not been answered. It seems to me that you already have the facts when you have used land plaster—which is a better absorbent than the floats—it doesn't give anything like the same results as the floats.

QUESTION: That might appear entirely satisfactory if we had any way in our work here of checking up the Gypsum effect as applied alone?

HROFESSOR HOPKINS: Yes, gypsum has other effects than that of simply holding the nitrogen, but where Director Thorne has used gypsum with manure he has not obtained nearly as good results as with rock phosphate and manure.

QUESTION: You are comparing it upon the basis of gypsum?

PROFESSOR HOPKINS: No. I compared the rock phosphate and manure with the manure, used alone. The power of the rock phosphate to prevent loss of nitrogen must be a small factor as compared with the value of the phosphorus which it supplies. I just want to explain a moment upon this question that was raised here about fertilizer analyses. Here is about what we see on fertilizer bags:

TABLE 3—FERTILIZER ANALYSIS.

Name, "Soluble Ammoniated Bone and Potash."

ANALYSIS.

Available nitrogen	**1 25 to 2.50**
Available ammonia	1.50 to 2 75
Available phosphorus	**4.00 to 5 50**
Available phosphoric acid	9.00 to 12.00
Equal to bone phosphate	20 00 to 26.00
Total phosphorus	**6.75 to 8 50**
Total phosphoric acid	15.75 to 18.50
Equal to bone phosphate	24.25 to 42.50
Soluble potassium	**1.50 to 3.25**
Soluble potash	1.75 to 3.50
Equal to potassium sulfate	3.25 to 6.50

This the actual analysis of a fertilizer that is sold on the market. Now, remember that one per cent. is allowed the manufacturer—that he does not have to come within one per cent. of his guarantee. He could not be convicted if he drops one per cent. below his guarantee, at least that is the law in some states.

These are actual percentages: 1.25 per cent. of nitrogen to 2.50 but he has a limit of one per cent., so he is within the law if he has .25 of one cent. Now, it is rather a poor soil that does not have that much in it and you might just as well scatter one hundred pounds of good soil over your land as to depend upon the nitrogen guararnteed in that fertilizer.

Here is the available phosphorus: 4.00 per cent., and the total phosphorus, 6.75 per cent., and the absolute guarantee under the law is 3.00 per cent. available and 5.75 per cent. total. There is the potassium, guaranteed 1.50 per cent. and there is only .50 per cent. when you take off the one per cent. allowed the manufacturer. The minimum guarantee of phosphorus, namely, 4.00 per cent., available and 6.75 per cent. total is all that is worth while to consider in this long statement of analyses.

I have tried to see how it would compare if we put the selling of corn on the same basis.

TABLE 4—A BUSHEL OF CORN.

Shelled corn 56 to 65 pounds.
Equal to ear corn 70 to 90 pounds.
Equal to dry shocked corn 140 to 215 pounds.
Equal to green shocked corn 420 to 556 pouuds.

Suppose you go to a man and you want to sell him corn; you say "this is guaranteed to be from 56 to 65 pounds of shelled corn to the bushel, and that is equal to ear corn from 70 to 90 pounds; and it is equal in dry shock corn from 140 to 215 pounds and in green shock corn it is equal to from 420 to 560 pounds." And isn't there just as much sense in that as there is in putting all this stuff on the fertilizer bags?

You buy a fertilizer for the elements of plant food it contains and that represents the benefit you are to get out of it. As a rule we need to buy not a so-called complete fertilizer, but a single element of plant food to balance what we have in the soil. If you want to balance the soil with potassium I think the best thing to do is to buy and put on a material that contains, not two per cent. potash, but forty-two per cent. potassium. That is the way we put it on, and that is the way we make sixty bushels of corn to the acre on peaty swamp land that otherwise produced no corn at all.

QUESTION: Do you use what we call muriate?

PROFESSOR HOPKINS: Yes, potassium chloride is what we use—that is the better name to use in our literature. It tells what it contains, the two elements potassium and chlorine; it is just the simplest name to call it and it tells the farmer what it is and he understands it.

It is an actual fact that I worked two hours trying to tell a man how much potash there was in muriate of potash—and then he gave it up disgusted with my scientific explanation.

QUESTION: He wanted the professor to talk intelligently?

PROFESSOR HOPKINS: Yes, he did.

DOCTOR CHAMBERLAIN: By marking between such and such a per cent. with a possible chance to go one per cent. below it, I think great injustice is done to the manufacturer—and I am not a manufacturer. I find that they do not run one per cent below their lowest claim, but that they run almost one per cent. above their lowest claim, and I say that it is only fair to the manufacturer who sells his goods in Ohio to have that fact known. They run almost one per cent. above their lowest claim, and they run above the danger limit almost two per cent.

QUESTION: Don't they get paid for it, Doctor Chamberlain?

DOCTOR CHAMBERLAIN: Yes sir.

PROFESSOR HOPKINS: I heartily endorse that. Notwithstanding that, I will say there are manufacturers that go right down as close to the danger limit as they can, and they sell goods in our state, and I simply say it is better for any reliable manufacturer not to put those two figures on; there is no need adding confusion. The minimum guarantee is all that is necessary.

QUESTION: The largest manufacturers use but one set of figures?

PROFESSOR HOPKINS: Yes, they are coming to that more and more; they should never drop below, but they may go above and that reputation will come to them whether they use one set of figures or two.

QUESTION: Suppose you have a soil that will produce one hundred bushels and you get fifty; there is a limiting factor under those conditions?

PROFESSOR HOPKINS: Well it may be any one of these six factors, seed, soil condition, moisture, heat, light or plant food. But under normal conditions of soil in a corn country when you have the usual climatic conditions, a poor yield is very likely to be due to a deficiency of plant food.

QUESTION: If you have the conditions to make the large yield and don't get it after you apply the plant food, then what?

PROFESSOR HOPKINS: If you use manure or other low grades of plant food, it will take you some time to get the plant food well distributed. I have found people who put phosphate on a farm that needed it, and then asked why didn't they get the increase, and I found the phosphate lying on top of the soil, where they put it after the corn was planted. It was still there. You must have it thoroughly mixed with the soil. Put the plant food where the roots grow.

QUESTION: What is the L on the chart?

PROFESSOR HOPKINS: Lime.

QUESTION: Haven't you a symbol for the element calcium?

PROFESSOR HOPKINS: We use L as an abbreviation, not as a symbol for an element. Lime is not an element, and we do not add it as an element of plant food but simply as a compound which has power to correct the acidity of the soil. The oxide, or hydroxid, or the carbonate of calcium are used for this purpose, but other compounds of calcium, such as the sulfate or phosphate have no power to correct soil acidity.

CHAIRMAN THORNE: We are certainly very grateful to Doctor Hopkins for his most excellent address. I am sure we all regret we did not begin on schedule time this morning and that we did not have a whole forenoon for this paper, but as we have two other exercises to come and our time is so short it is with deep regret I must close the discussion.

We well now hear Mr. J. Warren Smith, director of the State Weather Service, whom we are very glad to have with us.

MR. J. WARREN SMITH: I am pleased to be here to tell you of the latest plan for getting the weather forecasts out into the rural districts of the state. You know these forecasts are made in the morning at about nine o'clock and telegraphed out from Washington to our office at Columbus, and then we telegraph them over the state. We have been telegraphing them to different points where persons would display flags or blow whistles or make the distribution by mail, or make it by telephone, without expense.

This forecast, as you understand, covers the probable weather conditions for the coming night and the next day; we seldom say anything about the current day. I find there is quite a misunderstanding about that. People think this forecast which they get in the morning—not in the morning newspaper, but I mean between ten o'clock and noon—is for that day. It is not. It is for the coming night and the next day.

Within a few weeks The United States Telephone company has arranged to make this distribution to all their exchanges in the state, without expense to any one. From Columbus, Cleveland, Toledo, Sandusky and Dayton the forecast is telephoned out to the main exchanges, then telephoned to the small exchanges—about four hundred of them—so that any one in any part of the state connected with any one of the Citizens' or Independent or Mutual telephone lines, whatever you are pleased to call them, connected with the United States system, can get the weather forecasts at ten o'clock in the morning.

The Bell people are beginning to take this up. They have started this plan at Dayton and we are in correspondence with them at several other points in the state, and my idea is that as soon as they find that it is a good advertising feature for them they will wish to be popular with the farmers as well.

While on my feet I wish to take just a moment to speak about long-range weather forecasts. You see them very often in the newspapers. I know you don't pay any attention to the almanac, but if the readers of the newspapers did not want a long-range weather forecast, I doubt if the newspapers would buy the information, as they do.

The weather bureau does not claim to be infallible, as you all know. We know that the business of weather forecasting has not become a true science as yet and that we are bound to make mistakes, but we do know that any one of you can make a long range weather forecast just exactly as good as those you see published in your local newspapers frequently. Professor Moore once said that he could take a hat pin and jab at a calendar and say that on that day it would rain, and it would be just as likely as any of these long-range forecasts.

The Bureau does not believe that we can tell you what the weather will be next month. We think the time is coming when we will be able to forecast the character of the season six months in advance, but we do not think it will ever be possible to pick out certain days, weeks or months and indicate what the weather will be.

You know these long-range weather forecasters word their information in such a way that they cannot fail. If you are at all familiar with the Bureau weather maps, you will see that frequently we will have an area of high pressure with fair weather over on the Pacific coast; along the Rocky mountains we will have a trough of low pressure and stormy weather; moving down the great eastern slope of the Rockies into the Mississippi valley will be another area of high pressure and fair weather; while over the eastern coast will be another stormy weather area and these areas are moving eastwardly at the rate of about five hundred miles in twenty-four hours, so that when a long-range weather forecaster says "stormy period across the great corn belt" between the fifteenth to the eighteenth, as they frequently do, it is almost impossible for them to make a mistake, because within that time there will be two stormy areas moving across that district, perhaps giving stormy weather in one place and maybe not in another.

I would be willing to go one better than Professor Moore did with his hat pin matter, and say that any of you might pick out any day next month or next year or within the next five years, and I will wager any amount that it will rain in the great central valley on that day.

I merely mention this because I wish to have you use your influence, as you go about over the state as farmers' institute workers, to show the difference between a prediction for thirty-six to forty-eight hours in advance in perhaps four or five different sections of a small state, of the exact conditions that are expected to prevail during each twelve hours, and the long-range forecast which says that during the latter part of next September or October, "look out for drought," or "next September we are likely to have a severe storm along the Atlantic coast," just the conditions which are liable to come, and nobody with any sense is likely to be fooled.

I shall be glad to answer any questions.

QUESTION: I would like to know what is the limit which you now make forecasts?

MR. SMITH: The forecast which is made in the morning is for thirty-six hours, and the forecast which is made at night and which appears in the morning newspapers, is for forty-eight hours.

Under exceptionally favorable conditions in the winter time it is oftentimes possible to forecast for three days, and we can make a fair guess for the fourth possibly, but when you get beyond forty-eight hours it is more of a guess than anything else.

CHAIRMAN THORNE: If there are no further questions, the next topic on our program is "How can the Institute Workers aid in Advancing the Live Stock Interests of Ohio?" by Charles McIntire,

INSTITUTE WORKERS AND THE OHIO LIVE STOCK INTERESTS.

BY CHARLES M'INTIRE.

The average Ohio farmer is a hard man to reach. He may take an agricultural journal and may receive the bulletins issued by the Experiment Station but seldom reads them. One thing he does, he attends one or more of the farmers' institutes held in his neighborhood, which affords one of the most practical methods of insisting upon his adoption of better methods of operating his farm.

There is one feature of Ohio agriculture, it seems to me, that has been neglected more than than any other, and that is the improvement of the live stock; and the institute worker should take advantage of the opportunity to impress upon the farmer the importance of improving his live stock. It is a sad

sight as one travels over our state, to observe the inferior quality of the animals kept by the average farmer in many parts of the state. There is no reason why the value of the live stock of Ohio should not be doubled without increasing the number.

Before anyone should attempt to teach others, however, he should be himself qualified. There is a growing demand in Ohio for up to date live stock men and I believe that young men should spare neither pains nor expense in qualifying themselves to become experts along this line. Zootechny is a useful and interesting study and the agricultural colleges of the country are doing a useful work in instructing young men along the lines of animal conformation and nutrition; but it is almost impracticable for one who is actively engaged in operating a farm to attend college.

One of the most practicable methods of instructing practical men along this line is the short course in stock judging, and in states where these schools have been held the farmers and stockmen have taken great interest in them and untold good has been accomplished by interesting the farmers in the Experiment Station where the course has been held as well as building up the great live stock interests of the state. Ohio is in arrears in facilities for stock judging that are accessable to the practical farmer.

There are many reasons why Ohio should and *no* reason why she should *not* have a short course in live stock and corn judging, similar to those held in Iowa and other states last winter, which demonstrated their practicability and usefulness.

The reason why Ohio does not have these schools is because neither the Experiment Station nor the College of Agriculture has funds sufficient for their maintenance. The department of animal husbandry alone at the Illinois Experiment Station was two years ago appropriated funds almost equal to the entire appropriation received by the Ohio Station last winter, and farmers all over the country are beginning to realize that this was a good investment for the state. We earnestly hope that Ohio in the near future will be able to hold a short course in stock judging annually.

The stock shows of the country have done and are doing much to advance the live stock interests, but from the standpoint of instruction in stock judging they are not what they should be, from the fact that they do not go far enough. The awards are made, the judge does not give his reasons for placing the awards, the on-looker is not given an opportunity to examine the animals, which are immediately led out of the ring and none are the wiser. This, however, is not the fault of the judge, the member in charge, the superintendent nor the exhibitor, from the fact that much time would be required for the judge to give his reasons, and for the spectators to examine the animals, and while the classes are being judged it would be almost impracticable to do this.

It seems to me a short course in stock judging, held in connection with the state fair, would be highly commendable. Exhibitors would probably furnish the animals and about all required would be to secure the services of an expert judge who could properly place the animals and give his reasons for so doing.

The pointing out wherein one animal excels another, calling attention to the desirable and defective points and then giving those interested an opportunity to examine the animals, has been found to be the most satisfactory and commendable method of imparting instruction in stock judging. A few farmers' institute committees are now contemplating devoting one session of their institute to study of animal conformation, and the instructors sent out by the state will be expected to take charge of this feature of the institute. Hence the importance of being prepared.

Not only should the institute worker be able to judge animals properly, but if he has produced and owns animals which have proved profitable and can tell just what these animals have done and what can be expected of them, it will add greatly to his influence among the people.

The institute workers should keep in close touch with the live stock investigations of the Experiment Stations and should take pains to interest the public in them. These institutions are working out problems which would be absolutely impossible for any individual to solve, and facts established with live stock can be generally depended upon to stand anywhere throughout the state.

By taking advantage of the opportunities afforded and by coming in contact with the farmers of the state generally, there is no reason why the institute worker should not do much for the upbuilding of the great live stock interests of Ohio.

CHAIRMAN THORNE: It is now 11:40 and we will use a few minutes for discussion of this paper.

MR. BRADFUTE: The question of bringing approved methods and improved forms of animals before the people of the State of Ohio is a pretty diffiicult matter. It has been and I think, Secretary Miller finds it still pretty difficult to find men who are competent to discuss these questions, who are willing to leave their live stock farms and give their time to the people. In the winter season they must attend strictly to their own live stock, unless they are so situated that they can leave it in other hands.

I certainly approve the statements made by Mr. McIntire, regarding schools for the judging of live sttock. The young men who are graduating from the live stock departments of the universities are the men who are being especially trained in this work. It is possible that a man may talk intelligently upon cattle, and people may think he should be able to talk on sheep also, or upon horses. The man who thoroughly knows one subject may not be fitted to talk as intelligently as he ought to upon the other subject, but the young men who are graduating from the universities today are not trained entirely on one line, but they are being trained along the four or five lines of live stock. The only drawback is lack of actual contact with the animals and actual experience. They will lack that and they are bound to lack that for that can only come with the having had the actual contact and experience, and yet these young men are gaining this very rapidly, and I have heard many young men—especially those from some of the universities who have had training along this line—who can give a very competent talk upon the improvement in live stock. Like Mr. McIntire, I think we shall have to depend pretty largely along that line for the training.

Another matter was mentioned, that of live stock schooling at the fairs. That is a good thought if it will work. One difficulty would be that at the time of the fair there is too much coming and going, and another difficulty would be to find men who are willing to take an animal which has been thoroughly fitted, and in which he takes a great deal of pride and has a great deal at stake, and stand that animal before the public for about three hours and have men, who think they know a great deal, punch their fingers into its ribs until it goes back to the stall partly ruined for the next week's show. A great many men seem to think they can not tell what an animal is made like until they punch half way through between his ribs. But see an expert judge, and he goes along merely touching the animal here and there. Therefore, I say you will have difficulty in getting men to bring out fine animals for that purpose.

Otherwise if the stock men could be gotten off to a corner somewhere, I believe it would be a most excellent and feasible scheme, but under the circumstances it would be a very difficult matter to arrange for it and carry it out.

MR. SCOTT: I want to read a resolution if it is in order:

"*Be it resolved* that we who have been in attendance at these meetings through the kind invitation of the Board of Control of the Ohio Agricultural Experiment Station, extend to them our gratitude and pleasure for the profit and hospitality received from their hands during these meetings."

Do I get a second?

MR. W. W. MILLER: On behalf of the State Board of Agriculture I want to make a very emphatic second to the resolntion.

MR. W. W. FARNSWORTH: On behalf of the Ohio State Horticultural Society I second the adoption of the resolution.

CHAIRMAN THORNE: I want to thank you on behalf of the Station for the kind attention you have given. We hope these meetings may be continued from year to year.

And thereupon a sine die adjournment was taken.